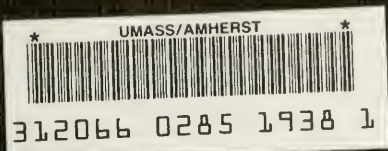


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REPORT
OF
HARBOR AND LAND
COMMISSIONERS


1901

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ANNUAL REPORT

OF THE

BOARD OF HARBOR AND LAND COMMISSIONERS.

FOR THE YEAR 1901.



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1902.

Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1901, covering a period of twelve months, from Nov. 30, 1900.

From Dec. 1, 1900, to Nov. 30, 1901, the Board has held 224 meetings, has given 322 formal and informal hearings, and has received 177 petitions for license to build and maintain structures and for privileges in tide waters and great ponds, to dredge material, to remove material from beaches, and for other purposes.

One hundred and twenty-four licenses for structures and privileges in tide waters and great ponds have been granted during the year; also 37 permits for dredging, for the removal of material from beaches, and for other purposes.

Sixty-five inspections have been made by the Board at various times of work completed and in progress, under appropriations made by the Legislature, in Boston harbor, on the Commonwealth flats at South Boston, the Province Lands in Provincetown, protective works on Connecticut River at Hadley and West Springfield, concrete sea wall on Scituate beach, jetties and channel at West Bay, Osterville, and at Lake Anthony and Menamsha Inlet, Witchmere harbor, Scorton harbor, and location of boundary line between Massachusetts and New Hampshire on Salisbury beach; also of anchorage ground in Boston harbor, proposed location of Northern Avenue and bridge, Ragged Island in Hingham harbor, canal route between Boston harbor and Narragansett

Bay, Stony beach in Hull, Charles River, Merrimac River, Bass River, Herring River, North River, Scussett River, Sandwich harbor, Apponagansett harbor; also of the sites of proposed work in tide water and great ponds, upon petitions and plans presented to the Board, the location of wrecks and obstructions to navigation, and various structures built under licenses from the Board.

Through transactions of the Board there has been paid into the treasury of the Commonwealth during the past year, from rents, licenses, and sales of land, the aggregate sum of \$59,751.56.

During the year 11 new contracts* were made by the Board, duly authorized for the estimated expenditure of \$152,018.59.

On August 1, the Board executed a bond for a deed of conveyance from the Commonwealth to George C. Corcoran of 31,500 square feet of land on the Commonwealth flats at South Boston, bounded by Anchor, Bullock and D streets, for \$15,750, and other considerations of importance and value to the Commonwealth.

On November 26, the Board executed a deed from the Commonwealth to the trustees of the Boston Real Estate Trust of 188,126 square feet of land on the Commonwealth flats at South Boston, bounded by Summer, D, Fargo and E streets, the consideration being \$263,376.40. This deed was given in accordance with the provisions of a bond from the Commonwealth to the said trustees, dated Jan. 10, 1899.

COMMONWEALTH TIDE LANDS.

On November 26, a license was granted to the Boston & Maine Railroad to extend Pier 5, Hoosac Tunnel Docks, on Charles River, to the harbor line established by chapter 479 of the Acts of 1897. The Board recommended the payment of \$3,615.75 by the licensee for the rights and privileges granted in tide-water land of the Commonwealth to be covered by the proposed extension, and to be used as a dock appurtenant to said extension, the area being 4,821 square feet. This amount was determined by the Governor and Council, Nov. 27, 1901, under section 16 of chapter 19,

* See Appendix A.

Public Statutes, to be just and equitable. The amount thus received will be paid into the compensation fund for Boston harbor, under chapter 146 of the Acts of 1897, the income of the fund being available for use by the Board in the improvement of that harbor.

BOSTON HARBOR.

The deep and sheltered anchorages in the lower harbor of Boston, together with the safe approaches thereto, entitle it to be classed among the best of natural harbors. The need of deeper channels from the wharves to the sea is an oft-told tale, but it is one which must be repeated and reiterated. They are not the needs of caprice or fancy, as all know, but rest on the solid basis of continued commercial prosperity to the capital city of New England, which is the chief natural outlet for exports from the great north-western territory in vessels of modern type.

In 1892 the federal government, whose duty it is to provide the sea coast harbors with sufficient depth of water ways, in order to enable the ports to meet the growing demands of commerce, approved the project for deepening the main ship channel of Boston harbor to 27 feet at mean low water for a width of 1,000 feet, as far up as the south ferry to East Boston. While this work was under way, it was found that when completed, owing to their greater draft, the channel would be inadequate to the requirements of modern ocean steamships, and consequently other projects were matured and entered on for still greater depths of channel.

In 1899 Congress appropriated \$455,000 for the purpose of dredging a new channel from President Roads through Broad Sound to the sea, to be 30 feet deep at mean low water and 1,200 feet wide, and the same is now considerably more than half done.

These projects for improvement, however, failed to keep pace with the increase in the size and depth of the steamships, and still another project was matured, providing for a channel 35 feet deep, and in width varying from 1,200 to 1,500 feet, from the sea up to the Navy Yard and to the first bridges on the Charles and Mystic rivers respectively.

This project passed the lower House of Congress at its last session, but failed in the Senate. It is expected that the same project will be again favorably reported from the rivers and harbors committee, and that an appropriation therefor will be made in the rivers and harbors bill of the Congress now sitting. Every argument and influence in favor of such appropriation should be brought to bear, not only upon our Representatives and Senators at Washington, but also upon all others there having the prosperity and welfare of New England at heart. The voices should never be stilled until our needs in this direction are satisfied.

Within the past decade ocean steamships have grown without precedent in size and capacity. To-day vessels are building for Atlantic carriage with a gross tonnage capacity of 10,000 to 20,000 tons, a displacement from 15,000 to 37,000 tons, and carrying a draft of 28 to 36.5 feet. Among the class referred to, and one of, if not the largest, is the "Celtic," built in 1901. She is 9 feet longer than the "Great Eastern," 1 foot deeper from the same deck, and of 10,700 tons more displacement. Her dimensions, which may somewhat suggest the least extent to which current projects for improving the channels of Boston harbor shall make provision, are as follows: length over all, 700 feet; beam, 75 feet; molded depth, 49 feet; draft when full laden, 36 feet 6 inches; displacement at that draft, 37,700 tons. She can carry 20,900 gross tons, and 2,859 passengers of whom 347 may be first class, at a sea speed of 16 knots.

Economic reasons are the cause which has led to this increase in depth and cargo capacity, and the possibilities of harbor accommodation alone will for some time to come be its limitation. Reduction in the cost of transportation is a constant aim, as is also increase in speed. Both objects are attainable to their extreme limit only by increasing the draft of the vessel proportionately to her length and beam. Consequently, the port that offers the deepest approaches to the wharves will have gained no small advantage.

Other ports are preparing to meet the requirements of these leviathans of the deep, and Boston must not be behind.

At New York the federal government is dredging a channel to the sea 40 feet deep and 2,000 feet wide.

At Liverpool new docks are building, and the sills of others are being lowered.

Bristol, Eng., was granted authority by Parliament at its last sitting to make an expenditure of £2,775,000, or about \$13,875,000, for building docks and terminal accommodations at the Avonmouth, with a view of providing not only for the new type of combined cargo and passenger steamships, but for handling a large passenger service, which it is believed her location, favorable to a fast passenger line to Boston, together with quick train despatch of some two hours to London, will justify.

The railroad consolidations lately authorized by the Commonwealth have placed Boston in a position of favorable competition for exports from the great territory naturally her tributary. The railroads themselves have been and are making expenditures freely, to enable them to offer larger facilities and preserve their economic standard of low cost in handling cargoes. The complete separation of passenger and freight service afforded by the new two-storied shed at the Hoosac Tunnel Docks is not only fulfilment of a long-felt want, but an indication of the permanent growth of transatlantic passenger sailings from this port. It is a distinct encouragement to the belief, entertained by not a few, that the advent of the made-up train of Pullmans, awaiting alongside the passenger shed for passengers to enter as soon as the customs examination of luggage is over, that they may be whirled without delay to their homes in the cities of the west, is not far distant. The passenger accommodations at Liverpool and Southampton have shown this side the water how to do it. The tide of passenger travel is setting towards this port, and attention to the greater comfort and convenience of travellers is alone needed to secure a large and permanent passenger patronage.

The Main Ship Channel. — It is now nine years since the project was adopted by the federal government for improving the main ship channel by deepening to 27 feet and widening to 1,000 feet, at an estimated cost of \$1,250,000.

It may be interesting to note the progress of the improvement. The annual report of work done in this district under the United States engineers in charge since the first appropriation in July, 1892, shows the following:—

The amount expended to June 30, 1900, was \$825,258.18, all upon improvement. With the amount expended during the fiscal year ending June 30, 1901, the channel 27 feet deep between President Roads and Boston was increased in width 500 feet to the full width of 1,000 feet, excepting for a length of 3,400 feet at the "upper middle," where its width is still only 500 feet; but at the "lower middle" several groups of ledges restrict the available width of the channel to 600 feet. On June 30, 1901, the maximum draft that could be carried over the shoalest part of the improvement was 26 feet at mean low water.

The Broad Sound Channel. — The project was approved by Congress in March, 1899, for deepening the channel through Broad Sound to a depth of 30 feet at mean low water for the width of 1,200 feet, at a cost of \$455,000. The work has progressed so that now there is a depth of 30 feet for a width of 775 feet. This channel cannot, however, be made available for use until its approaches have been carefully swept to ascertain if there be any boulders or ledges projecting above the guaranteed depth. As this class of work requires the greatest care and a smooth sea, it will not be done and the new channel buoyed before next summer.

The Thirty-five Foot Channel. — In June, 1900, a survey of the harbor of Boston was authorized by Congress, with a view to provide channels 35 feet deep. A project was reported to Congress in favor of a new channel through Broad Sound into President Roads, 2,000 feet wide and 35 feet deep, to run through the shoals just east of Faun bar. The borings taken in the proposed channel failed to discover any ledge, although one exists just outside which would be dangerous to navigation unless removed. This project included dredging the upper channel to a depth of 35 feet, 1,500 feet wide. Here large quantities of ledge were discovered, which it is estimated will cost \$2,371,770 to remove. The total cost of the project recommended to Congress was estimated in round figures at \$10,500,000. After

suffering a reduction at the hands of the committee of about \$2,000,000, the project which passed the House provided for a channel through Broad Sound 1,500 feet wide and through the upper harbor 1,200 feet, with a depth throughout of 35 feet, and authorized the expenditure of \$8,000,000, with an appropriation of \$3,600,000 available for immediate work.

New avenues of approach need new lights for guidance. Upon completion of the Broad Sound channel, it will have to be buoyed and lighted. To mark the new entrance to the harbor, it becomes necessary to erect a new lighthouse upon or near the Graves, an island or ledge of rocks extending farthest towards Nahant. In order that the new light may be ready to shine as soon as the pathway shall be ready for travel, the Board has communicated with the federal authorities, reciting the needs of the situation, and asking that suitable action may be taken.

ANCHORAGE GROUNDS.

The project presented by the Board in its report last year for the improvement of anchorage grounds between the main ship channel and Bird Island shoal received the sanction of the Legislature by the enactment of chapter 476 of the Acts of 1901. Section 3 of that act requires this Board to obtain from the owners of Bird Island shoal a release of all their right, title and interest therein, without expense to the Commonwealth, before exercising the powers conferred by the act. The title to the shoal is untraceable. It is supposed to have been in the city of Boston, and at the request of this Board the city has executed to the Commonwealth a release of all its right, title and interest thereto. As that release, however, failed to quiet the title, it was thought best to appeal to the Court of Registration for the purpose of having the title of the Commonwealth finally settled. As soon as the question of title is adjusted the Board expects to proceed with the work authorized by the act.

WINTHROP CHANNEL.

Since the dredging of the channel in Winthrop harbor in 1900 there has been a deterioration, and certain shoal spots were found to exist which impeded at extreme low tide the

passage of the steamers accustomed to ply between Boston and Winthrop at schedule hours. A survey made in May, 1901, disclosed the nature and the extent of the shoaling, and a contract was subsequently entered into with the Bay State Dredging Company to remove the same to a depth at mean low water of 9 feet, for 29 cents per cubic yard. The work was completed June 7, 2,586 cubic yards of material having been removed, at a cost of \$749.94. Thereafterwards the steamers made their daily trips during the season, and no complaint of insufficient depth of water has reached the Board. As the channel is narrow and its sides are high mud flats, it cannot be expected to maintain itself without deterioration, and further dredging from time to time will undoubtedly be required. As this channel is not only a highway of passenger travel to and from Winthrop throughout the summer, but also an increased convenience to boatmen of all classes along that shore, it is deemed by the Board to be worthy of improvement.

SHIRLEY GUT.

In April, surveys were made at Shirley Gut to determine the extent of growth at the end of Point Shirley since the survey of the previous year, and also the amount of excavation required to preserve navigation through the Gut. It was found that the rate of increase of the growth had been the same as for previous years, and it therefore became necessary to make a taking of the end of the point for the purpose of enabling the Board to do the required dredging. On April 23, 1901, a taking was filed in the registry of deeds for the county of Suffolk of about 14,000 square feet of land, above high-water mark and flats lying between it and the Gut. Conferences have taken place with the owners, but as yet the Board has not been able to effect a settlement. Subsequently, about 13,000 cubic yards of material was dredged from the point, thereby excavating the channel to the depth of 12 feet at mean low water. It will presumably be necessary to continue this dredging annually, in order to remove the material deposited on the end of the point by the winter storms.

HULL.

The Board was directed, by chapter 483 of the Acts of 1901, to build such sea walls or other structures in the town of Hull as it may deem necessary for the protection of the outer Boston harbor shore from encroachments or damage by the sea, between Allerton and the retaining wall of the New York, New Haven & Hartford Railroad Company, and authorized to expend for this purpose an amount not exceeding \$10,000. This act was approved June 10, 1901, but was not accepted by the town until September 12. Surveys, plans and specifications have been made, contemplating the building of about 1,490 feet of concrete sea wall and about 720 feet of spur jetties; but proposals will not be invited until a more favorable season for the prosecution of the work.

U. S. S. "ENTERPRISE."

Application was received from the Nautical Training School Commissioners, in November, 1900, requesting the Board to dredge a berth for the schoolship "Enterprise," at the North End Park pier. This was accompanied by a statement that no other place could be found for the vessel to lie in, and that the desired dredging was necessary to her safety.

As the proposal was one of an unusual nature, before determining upon the expenditure necessary for the undertaking, the approval of the Governor and Council was requested. That approval having been received, and the permission of the bath trustees of the city of Boston having been obtained, the dock was dredged alongside the bath pier at the North End Park to a depth of 17 feet at mean low water, 45 feet wide on the bottom and 225 feet long, at a cost of \$1,000.

THE COMMONWEALTH FLATS AT SOUTH BOSTON.

This tract of land, comprising about 170 acres of filled land, of which about 70 acres lie north of Summer Street and the balance south of it, remains substantially in the same condition as reported last year. The portion south of Summer Street is laid out with streets crossing each other at right angles, and these streets have been raised above the general level of the flats to grade 16, the established grade

for streets in this section of the city. It is reached from the city proper by Summer Street, which is a high-grade street, crossing the tracks of the New York, New Haven & Hartford Railroad by a bridge. A large part of the necessary drains and catch-basins for the surface drainage of the territory have been built, and are in good condition.

The principal work done during the year has been on the structures on the borders of this property, which are treated under their respective headings.

A dump for refuse material brought from excavations in the city to be disposed of, has been maintained, but the territory used for this purpose has become so nearly filled that the dump will probably have to be discontinued in the near future; in fact, the available territory for disposing of such material near the business section of the city has nearly all been filled.

A temporary use of various portions of the Commonwealth's property has been made during the year, under permits granted by the Board.

With a view to a beneficial effect upon future sales of this property, it is recommended that the Board be granted power, with the approval of the Governor and Council, to make alterations in plans heretofore adopted, and to alter, discontinue or relocate streets or ways.

The artificial channel through the flats, connecting the coal pockets with deep water, was enlarged in January by dredging, at a cost of \$1,000, paid out of the Commonwealth Flats Improvement Fund.

COMMONWEALTH PIER.

Work has been continued on the large new pier at South Boston, now called Commonwealth pier, 1,200 feet long and 400 feet wide, authorized by chapter 513 of the Acts of 1897, which has been under construction during the last four years. The sea wall and filling forming the core or solid portion was completed in 1899, and the oak pile platform, 50 feet wide, surrounding this solid core and forming the face of the pier, in May, 1901.

In order to provide a surfacing material over the clay filling, the Bay State Dredging Company, under a contract

dated May 16, deposited on the pier a quantity of coarse gravel of superior quality, for 35 cents per cubic yard. On May 31, a contract was made with Thomas Meany for carting and spreading this material on and adjacent to the pier, for 30 cents per cubic yard. There were 12,656 cubic yards of gravel placed on the pier, and the whole area of Northern Avenue, opposite the pier and adjoining docks, and about one-third of the area of the pier, were covered to the proposed street grade.

On September 6, a contract was made with the Eastern Dredging Company to complete the dredging in the dock on the westerly side of the pier to the depth of 30 feet at mean low water, the work to be completed Dec. 31, 1901, for $22\frac{1}{2}$ cents per cubic yard. Up to December 1, 46,560.4 cubic yards have been removed, and the balance of the work will undoubtedly be completed within the time named in the contract.

The cost of the work, up to December 1, from the appropriation of \$400,000, has been as follows:—

For sea wall and filling solid to grade 14,	\$215,076 30	
Surveys and supervision,	9,633 69	
	<hr/>	\$224,709 99
For construction of pile platform,	\$128,069 37	
Surveys and supervision,	2,603 24	
	<hr/>	130,672 61
For dredging westerly dock,	\$8,904 68	
Surveys and supervision,	91 00	
	<hr/>	8,995 68
Gravel surfacing,	\$8,226 40	
Surveys and supervision,	180 00	
	<hr/>	8,406 40
	<hr/>	<hr/>
Total,		\$372,784 68

The amount required to complete the work now under contract is estimated to be about \$6,600.

A number of applications have been made during the year to use the pier for tying up and discharging vessels, but the inaccessibility of the location from the land has prevented the making of any satisfactory arrangements for permanent use.

NORTHERN AVENUE AND BRIDGE.

One step forward was taken during the past year towards securing the necessary additional means of access to the Commonwealth's property at South Boston by the construction of Northern Avenue and bridge, as contemplated by the four-part agreement executed in 1873, under which the Commonwealth, the city of Boston, the Boston Wharf Company and the Boston & Albany Railroad Company began the development of what is now known as the South Boston flats.

Chapter 507 of the Acts of 1901 lays out Northern Avenue, provides for its construction by the city of Boston and for the payment of a portion of the cost thereof by the Commonwealth, as well as for the release by the New England Railroad Company, the successor to the Albany Railroad Company in the ownership of the property, of the land on the South Boston side. The plan of location may be found appended. The act was limited to take effect upon its approval by the city council of Boston. On October 16, the following letter was sent to the mayor of Boston, requesting his early consideration of this matter and its presentation to the city council for action : —

OCT. 16, 1901.

TO THE HON. THOMAS N. HART, *Mayor of Boston, City Hall, Boston.*

SIR : — By chapter 507 of the Acts of 1901, the Legislature "laid out Northern Avenue in the city of Boston, from Atlantic Avenue near Oliver Street easterly to Fort Point Channel ; thence across said channel by a bridge and thence across lands of the New England Railroad Company and its lessee, the New York, New Haven & Hartford Railroad Company and lands of the Commonwealth."

Northern Avenue would cross the lands of the Commonwealth at South Boston along the water front, connecting the proposed Commonwealth piers, of which the first is now about completed, with Atlantic Avenue and the heart of the city in a direct course at grade.

The act was passed to enable the performance of a prior agreement relating to the filling and improvement of the South Boston flats, whereof the provisions benefiting all the parties thereto except the Commonwealth have been substantially performed.

Under the agreement the benefit to the city has been the creation of land of the present assessed valuation of over \$10,000,000, from which the city derives a portion of her taxes, also 100 acres additional remaining to be sold by the Commonwealth, and which will be taxed by the assessors of Boston. Legislation became necessary in order to enable the city and the other parties to honorably fulfil their obligations under the agreement. That fulfilment will give additional value to the Commonwealth's water front, and provide increased facilities for and accommodation to the commercial interests of the port.

These public benefits are in direct connection with the harbor improvements which are so much a matter of public knowledge as to require no comment here. Before the public can gain the advantages contemplated in this act, it must be accepted by the city council of the city of Boston.

The Board of Harbor and Land Commissioners, in behalf of the Commonwealth, and in the public interest, respectfully asks your early consideration of the foregoing, and requests that you may present the matter to the attention of the honorable city council.

For the Board,

WOODWARD EMERY,

Chairman.

As yet, final action has not been taken. In the event of a failure to accept the act, further legislation may become necessary.

BULKHEAD AND SEA WALL.

As stated in the report of last year, a contract was made with Augustus Bellevue & Co., on June 1, 1900, to build 1,100 feet of bulkhead for the purpose of partially enclosing the area east of the present filled portion of the South Boston flats, which had already been partially filled by material dredged in making various improvements on the Commonwealth's property. This work was completed Aug. 20, 1901.

Paid for construction,	\$12,309 18
Surveys and supervision,	559 23
	<hr/>
	\$12,868 41

The bulkhead is a very substantial structure, and has been reinforced and materially strengthened on its exterior side by broken stone brought from the main channel of the harbor, without cost to the Commonwealth, where it had been

blasted in the progress of the work carried on by the federal government for the improvement of the ship channel.

After enclosing the northern side of this area, the Board decided to extend the sea wall on its south side parallel with and 300 feet northerly from the northerly side of the reserved channel; and on March 7, 1901, a contract was made with William J. Lawler, the lowest bidder, to build about 1,350 feet of sea wall, at \$56.49 per lineal foot, the work to be completed Oct. 31, 1901. The work was commenced promptly, but, owing to the bad weather encountered in its early stages, the contractor was unable to make the necessary progress with the foundation, and the completion of the work has necessarily been delayed. The foundation is now finished, and the wall proper nearly completed. The amount expended up to December 1 is as follows:—

For construction,	\$54,724 06
Surveys and supervision,	1,183 70
	<hr/>
	\$55,907 76

The amount required to complete the work, including the reserve withheld under the terms of the contract for work already done, is estimated to be \$21,600, or about \$77,500 in all.

This territory is now so enclosed that the work of filling can be proceeded with at any time; the remaining or easterly side should be enclosed by a bulkhead as the work of filling progresses.

BORINGS ON AREA TO BE OCCUPIED BY DOCKS EAST OF THE COMMONWEALTH PIER.

Owing to uncertainty as to the area covered by the ledges which were known to exist along the pierhead line near the shoal called Slate Ledge, it was decided to make a series of borings, in order to ascertain the depth and extent of the ledges and the character of material overlying the same.

Work was begun in the latter part of July, and finished early in November. In all, 94 borings were made, covering an area extending easterly from Commonwealth pier about

3,500 feet. The borings were made to the depth of 40 feet below mean low water, unless ledge was found at a higher grade. The bottom was found to consist of silt covering a bed of clay; over and around the ledge was a bed of gravel and clay hard pan, varying from 4 to 10 feet in thickness. In this layer many large boulders were found.

The ledge along the harbor line was found to be above grade 40 feet below mean low water. It begins at a point about 1,300 feet east of the Commonwealth pier, and thence extends easterly a distance of about 1,700 feet, lying southerly from the harbor line on the area which it is proposed to use for piers and docks for 200 to 300 feet; at only a few places, covering a small area, does the ledge rise above a grade of 30 feet below mean low water. It extends a considerable distance out into the harbor, probably being an extension of the ledges found in the main ship channel, which are now being removed by the federal government. Plans have been made showing the location and results of these borings, and are filed for use in designing future structures.

COMMONWEALTH FLATS AT EAST BOSTON.

The claim of the East Boston Company for that portion of its flats taken by the Commonwealth under the provisions of chapter 486 of the Acts of 1897, for the purpose of preserving the public ownership of a portion of the shore front of the port of Boston, remains unsettled, and is pending in the superior court of the county of Suffolk. It is hoped that the case may be tried during the coming year, and the claim finally disposed of.

Following the lease of the Boston & Albany Railroad to the New York Central & Hudson River Railroad Company, — the latter has been enlarging its accommodations by extending docks and piers, under plans approved by the Board, and making other improvements along the south front of East Boston. The new ownership seems to justify anticipations for increased and constant shipments of western freights and cargoes from this port. Boston has now become one of the Atlantic terminals of the New York Central Railroad, with all its ramifications, from which it can make certain

classes of shipments more advantageously than elsewhere. Under these conditions, we may fairly expect to see a more extended development of that water front and a demand for larger yards. In order to properly handle its growing business, the tracks should come in at the east end of the water front, and thus serve expansion in the easterly direction, where lies the only opportunity for growth.

A commission has been sitting, under the provisions of chapter 390 of the Acts of 1899, for the purpose of eliminating the railroad grade crossings at many intersecting streets, and it has under consideration plans for removing the railroad tracks which now occupy a strip of land through the centre of the island, and placing them on the east side, contiguous to the water front. While there are obstacles to this plan, they are not insurmountable, and the result would afford ready and accessible railroad accommodations to the water front of more than one-half the island.

The Commonwealth is interested in the final determination of this question, as it now possesses a water front area in this vicinity the development of which depends in a measure upon the location of the tracks in solving the grade crossing problem, and the proceedings of the commission are closely watched by the Board and the Attorney-General.

In this connection it may be well to note the change in the harbor line at Jeffries Point, East Boston, by chapter 419 of the Acts of 1901, whereby an opportunity was created to extend future piers and docks for the berthing of vessels of modern size.

FORT POINT CHANNEL.

Early in the year petitions were received from the owners and tenants of the wharves on Fort Point Channel lying between Congress Street bridge and Rowe's wharf, to have the channel in front of their premises dredged, in order that a class of larger vessels might reach the wharves.

The Edison Electric Illuminating Company, the owner of one of the larger wharves, had already excavated a berth in front of its premises to a depth of 25 feet, for a distance of 60 feet from the harbor line.

The United States government had dredged to a depth of 23 feet the centre portion of the channel for a width of 175 feet from deep water in the harbor up to and through Con-

gress Street bridge; the Commonwealth and the Boston Wharf Company had dredged the space between the government channel and the South Boston shore to the same depth up to the wharves.

After examining the locality, it was decided that dredging to the depth of 20 feet from the government channel to a line 50 feet outside the harbor line on the Boston side would accommodate all the requirements of navigation, and plans and estimates were prepared for this work; and on February 14 a contract was made with the Bay State Dredging Company, the lowest bidder, to excavate this area to the depth of 20 feet below mean low water, the contract price being 25 cents per cubic yard. The work was completed in a satisfactory manner June 3, 1901, at a total cost as follows:—

For dredging,	\$14,817 25
Surveys and supervision,	609 48
	<hr/>
	\$14,926 73

which was paid out of the income of the harbor compensation fund.

Fort Point Channel originally had a depth of 8 to 9 feet at mean low water in the deepest part of the channel. As business increased and vessels required a greater depth of water, the Commonwealth dredged a channel up as far as Federal Street bridge, to the depth of 16 feet at mean low water. Shortly after, plans were made by the general government to dredge the channel 23 feet deep and 175 feet wide, and an appropriation was made to begin the work. This was expended in dredging up to and through Congress Street bridge. At that time the foundations of the New England Railroad bridge were not carried to a depth sufficient to enable the channel to be excavated to its full depth through that draw, and work was discontinued until such time as new foundations should be put into the railroad bridge. Since then the railroad bridge has been wholly removed, and Summer Street bridge erected substantially on the same location, so that now the work on the government channel can proceed as soon as further appropriation is made. To this end the attention of the federal government has been directed to the change in the situation. This channel is

greatly needed, as large steamers are constantly arriving with cargoes which should be discharged at the wharves above Mount Washington Avenue bridge, but are unable to get there on account of the shoal water.

The condition of the bridges on this channel is the same as stated in our last report, except that the construction of the approaches to Cove Street bridge is well under way, notwithstanding the work on the bridge itself, both over the channel and over the tracks of the Boston Terminal Company, has not been commenced.

SOUTH BAY.

By chapter 519 of the Acts of 1897, the Legislature provided for the abolition of the grade crossing at Dorchester Avenue, South Boston. The act directed a commission, to be appointed by the superior court, to "prescribe the details for the abolition of the grade crossing by relocating" certain parts of the Old Colony Railroad. By section 2 the Old Colony Railroad is required to construct a part of the railroad so relocated and connections as prescribed by the commission. It is further provided that the Commonwealth shall pay 20 per cent. and the city of Boston 15 per cent. of the cost.

The commissioners thus appointed heard the parties, and prescribed the locations and construction in a report confirmed by a decree of the superior court. In pursuance of this report and decree, the relocation was made and the construction carried on in the tide waters of the Commonwealth in South Bay. Prior thereto, in December, 1898, the Old Colony Railroad Company filed a petition and plans with the Board of Harbor and Land Commissioners, under the provisions of chapter 19 of the Public Statutes, asking the Board "to authorize such construction and filling, and for such further action in the premises as may be authorized or required by the statutes in such case made and provided." Subsequently, before action by the Board, the petition and plans were withdrawn; the work, however, was performed substantially in accordance with said plans, but without the approval of the Board, the railroad company contending that such approval was rendered unnecessary by chapter 519 of the Acts of 1897, and the doings in pursuance thereof.

The Board contended that this special act did not relieve the railroad company from the provisions of the general statutes, and held that they had displaced tide water by filling therein in South Bay, and thereupon, under the provisions of Public Statutes, chapter 19, section 14, assessed upon them the sum of 15 cents per cubic yard for 115,000 cubic yards of tide water displaced, and claimed that a payment of \$17,250 should be made therefor, which claim the Old Colony Railroad Company disputes, and the matter is in the hands of the Attorney-General, to ascertain the legal obligations of the railroad in that respect.

CHARLES RIVER.

The piers of the new Cambridge bridge across Charles River in the place of the old West Boston bridge are slowly rising above the surface of the water. It will be perhaps two years yet before the bridge will be open to public travel, and the temporary structures removed from the river.

The harbor line on the northerly side of the river between Harvard and Brookline Street bridges was changed by chapter 245 of the Acts of 1901, and made to conform to the line approved by the Secretary of War in 1890, for the purpose of establishing a uniform line along the bank, and the parkway of the city of Cambridge has been continued along the river front, in conformity thereto.

The high flats on the shoreward side of this line, between the end of the existing wall on the east and the Grand Junction Railroad bridge on the west, are being filled with material excavated from the river and deposited behind a temporary wooden bulkhead built to retain the same. In carrying out this improvement a large area of mud flats will have been removed from sight, to a minimum depth of 8 feet below mean low water.

Above Market Street bridge, on the Watertown side of the river, the Metropolitan Park Commissioners have done considerable work in excavating the bed of the river to obtain material for building up the banks in the construction of parkways.

By chapter 411 of the Acts of 1901 the harbor line in front of piers Nos. 6 and 7 of the Hoosac Tunnel Docks was changed, thereby obliterating an angle in the old harbor

line, and affording an opportunity for lengthening the dock on the northerly side of Pier No. 7.

During the summer a portion of Pier No. 5, Hoosac Tunnel Docks, was badly injured by fire. In rebuilding the wharf it was extended about 20 feet to the harbor line established by chapter 479 of the Acts of 1897. Owing to the increase in the width of steamers and the narrowness of the dock, 5 feet were cut off from the northerly side of the pier during rebuilding, thus increasing the width of the dock.

CHARLESTOWN DRAWBRIDGE OPENINGS.

On July 1 a letter was received from the city clerk of Boston, requesting approval by the Board, under section 28 of chapter 53, Public Statutes, of the following ordinance passed by the city council of Boston and approved by the mayor June 27, 1901, relating to the hours of opening the draw in Charlestown bridge:—

[ORDINANCES OF 1901, CHAPTER 7.]

AN ORDINANCE RELATING TO THE HOURS OF OPENING THE DRAW IN CHARLESTOWN BRIDGE.

Be it ordained by the City Council of Boston, as follows:

Revised ordinances of 1898, chapter thirty-eight, section three, is hereby amended by inserting in line thirty-four of said section, after the word "tow," the words:—"but he shall not allow any vessel to pass through the draw of Charlestown bridge, so called, except such vessels as shall be ready to go through at the following times: 6.30 A.M., 9.30 A.M., 11 A.M., 12 M., 1.30 P.M., 3 P.M., 8.30 P.M., 11.30 P.M., and from 11.30 P.M. to 6.00 A.M."

IN COMMON COUNCIL, June 20, 1901.

Passed. Sent up for concurrence.

DANIEL J. KILEY,
President.

IN BOARD OF ALDERMEN, June 24, 1901.

Concurred.

JAMES H. DOYLE,
Chairman.

Approved June 27, 1901.

THOMAS N. HART,
Mayor.

A true copy. Attest:

EDWARD J. DONOVAN,
City Clerk.

Public notice was given that the Board would hear all persons interested in the granting or refusing approval of the ordinance above recited, at the office of the Board, on July 8, 1901; and on that date parties in favor of and those opposed to the approval of the ordinance were fully heard. After consideration of the matter, the Board on August 1 took action, as will appear in the following letter: —

Boston, Aug. 1, 1901.

A. J. BAILEY, Esq., *Corporation Counsel, Boston, Mass.*

DEAR SIR:— After carefully considering the schedules of the hours for opening the Charlestown bridge for the passage of vessels, as submitted, the Board is not satisfied that there is a sufficient number of openings to meet the requirements of navigation, and therefore cannot give its approval.

The Board respectfully suggests some further inquiry, with a view to ascertaining if the interpolation of another time of opening, between 9.30 and 11 A.M., and two more at a little after 4 and 7 P.M., would not better subserve the interests of navigation without materially increasing the impediment to travel necessarily occasioned by opening the draw; and would draw attention to the consideration that the addition of the three openings suggested would still be two less than the thirteen openings provided by the railroad companies.

Yours truly,

WOODWARD EMERY,
Chairman.

MYSTIC RIVER.

There has been no change in the physical condition of this river since the report of last year, beyond the completion of the Malden bridge, in accordance with plans approved by the Board. The draw in the new bridge was made 50 feet wide to accommodate the increasing size of craft.

During the year, claims for displacement by filling on the west side of the river have been made up and put into the Attorney-General's hands for collection. These claims are liable to be contested, on the ground that prior legislation has exempted the owners of flats on that side of the river, within a limited territory, from the payment of compensation for tide water displaced. These contentions raise questions of law which it will be necessary to take to the supreme judicial court for decision, before the rights and obligations of

the Commonwealth and the contending parties can be ascertained and settled.

Under the project of the federal government, 86,511 cubic yards of material were dredged below the mouth of Island End River, giving a depth of 25 feet at mean low water in the channel.

The New England Gas and Coke Company have continued their improvements by dredging and the building of structures in Island End River, in accordance with plans approved by the Board. In all they have removed 397,552 cubic yards by dredging in the Mystic and Island End rivers, adjacent to their property.

WEYMOUTH FORE RIVER.

Among the licenses granted during the year, none presages more of benefit and prosperity to the water side of Boston than those permitting improvements and the erection of structures in tide water at the works of the Fore River Ship and Engine Company, on Weymouth Fore River, at Quincy.

Shipbuilding at the port of Boston is reviving. In place of the wooden clipper ships of the last century, we are now building steel vessels of modern type and design. One of the largest and the best-equipped steel ship building plants in the country is rapidly developing on this river, the water of which runs into Hingham bay, with a depth sufficient to float battle ships now building of 15,000 tons and upwards, thence through Nantasket Roads into the main ship channel of Boston harbor.

In order to enable vessels built at the works of this company to pass out of the river, the county commissioners of Norfolk, in rebuilding the Quincy and Weymouth bridge, have provided for two draw openings, each 100 feet in width.

MERRIMAC RIVER.

On October 8, a petition was received from Samuel W. George and other prominent citizens for a relocation and extension of the harbor line on the northerly side of the Merrimac River, in Haverhill, "to such an extent and in such manner as the Board may deem necessary to meet the requirements of business and public interests."

Pursuant to the provisions of law, the Board caused notice to be published, and on November 21 gave a public hearing in the city hall in Haverhill to the petitioners and all persons who desired to be heard on this subject.

The present harbor line was established by chapter 104 of the Acts of 1883, but, owing to the growth of business and changes in local conditions, the petitioners wish to have a new line established which will permit the erection of structures farther into the river, and at the same time give an opportunity for building a quay or bulkhead in water of sufficient depth to float a loaded barge or vessel.

It is recommended that a new harbor line be established, in accordance with a plan on file in the office of the Board.

CONNECTICUT RIVER.

In the spring of the year willow cuttings were planted in the banks of the river, where they were protected by the riprapping done during the previous year, that being a stretch of about 1,269 feet to a point nearly opposite the old Amherst road, running past the Hadley Almshouse. The willows are expected in this case, as heretofore, to spread their roots and form a solid network, thus holding in place the riprapping, and forming a perfect protection against the action of the current, waves and ice.

The river was inspected during the great freshet in April, when it rose as high or higher than at any time during the past thirty years; apparently no wind accompanied the freshet, and but little damage was done. No injury was occasioned to the banks where they had been protected under prior appropriations by the Legislature.

Later, the selectmen of Hadley were given authority to repair any injury to the banks within their town which have been protected through the agency of the Commonwealth.

In July, the Board, in pursuance of the authority and appropriation granted by chapter 94 of the Resolves of 1901, made a contract for protecting the banks at Hadley, from the end of the work done last year to a point near the mouth of Coleman's Brook, and employed E. C. Davis of Northampton to superintend the work. During the season the members of the Board, with the engineer, made inspections

of the work while it was progressing and upon its completion. The work was satisfactorily accomplished under the same method as had theretofore been successfully adopted, and was completed November 5.

The section of river bank treated this year extends from the northerly end of last year's work up the river to Coleman's Brook, — a distance of 1,455 feet. The area covered by the mats and riprapping is 19,989 square yards, at a cost of $53\frac{1}{3}$ cents per square yard, making a total cost for the entire work, including surveys, plan and estimate for proposed dike below the highway, of \$10,660.78.

Owing to some favorable circumstances, and the personal qualifications of the overseer in charge of the work, a considerable reduction in the cost per square yard of last year's work, which was $69\frac{7}{10}$ cents, is noticeable.

The completion of the protective works from the head of Front Street in Hadley around the "high banks," so called, to Coleman's Brook, includes a distance of 5,100 feet, or nearly a mile, and will in the future afford protection to the main part of the town from further encroachments of the river.

No other portion of the river bank in the town is exposed to the influences which have hitherto encroached upon the land now thoroughly protected; and no danger need be apprehended except from a small break below the highway, which will have to be protected by a dike, for which plans and estimates have been made, and the cost of which will be well within the unexpended balance of the appropriation already made.

In the prosecution of the work it became necessary to purchase some equipment, in the nature of scows, which could not be hired, together with tools and material, for which there is no further need; and it is recommended that authority be given the Board to sell such things after the entire work is completed, and turn the proceeds in to the treasury of the Commonwealth.

The unexpended balance of the appropriation now available is \$7,728.01.

The report* of the engineer in charge may be found in the Appendix.

* See Appendix B.

NEW BEDFORD AND FAIRHAVEN BRIDGE.

It will be remembered that chapter 99 of the Resolves of 1899 constituted the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners a joint Board for the purpose of investigating and reporting upon the subject of relocating and widening the New Bedford and Fairhaven bridge over the Acushnet River.

The joint Board made its report to the Legislature, (House, No. 278) on Jan. 22, 1900. The Legislature adopted the report, and, by chapter 439 of the Acts of 1900, constituted the said commissions a joint Board to prescribe the manner in which so much of the highway, bridge and approaches as remained to be completed should be constructed, and to approve all plans, specifications and requirements necessary to finish the undertaking.

As stated in the report of last year, the joint Board, under the provisions of chapter 439 of the Acts of 1900, approved the contract and specifications for building a temporary bridge, and also removing the old bridge.

On Jan. 25, 1901, after hearings, duly advertised, at which all persons interested had an opportunity to appear before the Board and be heard upon all matters pertaining to the completion of the bridge under the provisions of chapter 439 of the Acts of 1900, the following order was passed:—

ORDER.

COMMONWEALTH OF MASSACHUSETTS.

In Joint Board of the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners of the Commonwealth.

In Re RELOCATION AND COMPLETION OF THE BRIDGE OVER THE ACUSHNET RIVER BETWEEN THE CITY OF NEW BEDFORD AND THE TOWN OF FAIRHAVEN.

Board of Railroad Commissioners: Hon. James F. Jackson, chairman; George W. Bishop; Hersey B. Goodwin. Board of Harbor and Land Commissioners: Hon. Woodward Emery, Chairman; Clinton White; Charles C. Doten. Hon. Woodward Emery, chairman of joint Board.

At a meeting of the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, sitting as a joint Board

by virtue of the authority of chapter 439 of the Acts of the year 1900, at which all the members were present, held this twenty-fifth day of January, 1901, it was adjudged as follows, to wit:—

Whereas, by act of the Legislature, Resolves 1899, chapter 99, it was “*Resolved*, That the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, who are for this purpose constituted a joint Board to act by a majority vote of all the members thereof, are directed to consider the matter of the completion of the New Bedford and Fairhaven bridge over the Acushnet River, and to report to the next General Court, on or before the fifteenth day of January, what has been the expense of said bridge as far as constructed; also to report how and in what manner the bridge and the approaches thereto on the New Bedford side should be completed, including the abolition of any railroad grade crossing, the probable expense thereof, and by whom the work should be done, and by what parties the expense should be borne and paid; and that no contracts be made by the county commissioners of Bristol County in respect to said bridge until authorized by the General Court”;

And whereas, in pursuance of said resolve, the said joint Board made a report to the Legislature, as follows, viz.:—

COMMONWEALTH OF MASSACHUSETTS.

REPORT OF THE JOINT BOARD UPON THE SUBJECT OF RELOCATING AND WIDENING THE NEW BEDFORD AND FAIRHAVEN BRIDGE OVER THE ACUSHNET RIVER.

To the Honorable the Senate and House of Representatives of the Commonwealth in General Court assembled.

By chapter 99 of the Resolves of 1899, the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners were constituted a joint Board for the purpose of investigating and reporting upon the subject of relocating and widening the New Bedford and Fairhaven bridge over the Acushnet River. The resolve reads as follows:—

RESOLVE TO PROVIDE FOR AN INVESTIGATION BY THE BOARD OF RAILROAD COMMISSIONERS AND THE BOARD OF HARBOR AND LAND COMMISSIONERS RELATIVE TO THE RELOCATING AND WIDENING OF THE OLD BRIDGE OVER THE ACUSHNET RIVER BETWEEN THE CITY OF NEW BEDFORD AND TOWN OF FAIRHAVEN.

Resolved, That the board of railroad commissioners and the board of harbor and land commissioners, who are for this purpose constituted a joint board to act by a majority vote of all the members thereof, are directed to consider the matter of the completion of the New Bedford and Fairhaven bridge over the Acushnet river, and to report to the next general court on or before the fifteenth day of January, what has been the expense of said bridge as far as constructed; also to report how and in what manner the bridge and the approaches thereto on the New Bedford side should be completed, including the abolition of any railroad grade crossing, the probable expense thereof, and by whom the work should be done, and by what parties the

expense thereof should be borne and paid; and that no contracts be made by the county commissioners of Bristol county in respect to said bridge until authorized by the general court. [*Approved June 2, 1899.*]

The joint Board published notices in sundry newspapers, in order to give all persons interested an opportunity to be heard, and gave hearings at the office of the Railroad Commissioners in Boston. They also personally pursued inquiries and made investigations. In a body they inspected the locality of the proposed bridge at New Bedford, and all places in the vicinity which might tend toward aiding in a solution of the questions involved.

The interests to be affected were represented by eminent counsel, who laid before the joint Board the history of proceedings relative to the bridge from its inception; presented the points of view and the interests both of public and private nature involved in the undertaking, and prepared and argued elaborate printed briefs in support of their contentions. Stenographic reports of the hearings before the legislative committee of last winter, and of a hearing before the Grade Crossing Commissioners, appointed prior thereto, were placed in the possession of the Board, and freely referred to.

After fully hearing all desiring to be heard and carefully considering the questions presented, the joint Board unanimously concur in answering the questions submitted to it by the Legislature as follows:—

I. With Reference to the Expense of said Bridge as far as constructed.

The treasurer of the county of Bristol reports that the whole amount expended on account of the New Bedford and Fairhaven bridge from the first itemized charge in 1894 down to Jan. 1, 1900, is \$810,932.30. This sum includes:—

The construction account of the bridge proper, . . .	\$632,078 09
The land damage account,	129,854 21
The interest on county notes,	49,000 00

II. How and in what Manner the Bridge and the Approaches thereto on the New Bedford Side should be completed, including the Abolition of any Railroad Grade Crossings.

The Board did not consider this as a purely grade crossing question, but as one involving the proper approaches of an expensive highway bridge, 70 feet wide, with some attempt at architectural effect, and realized that it should be studied with reference to its having been already more than half built, and to its being finished with some regard to the wishes of the community upon whom would fall a large part of the burden of paying for it.

In this deliberation, the existence of a steam railroad crossing, with its necessarily attendant dangers and inconveniences, was an essential factor.

A brief review may aid in comprehending the present situation. An ancient highway, 30 feet in width, crossed the Acushnet River between the town of Fairhaven and the city of New Bedford by a bridge and

over the intervening Pope's and Fish islands. On the New Bedford side this highway was intersected by the tracks of the Old Colony Railroad at grade, in the year 1873, and trains for passengers and freight have since passed and repassed along the water front of the city daily, at frequent intervals intercepting public travel over the highway.

The Union Street Railway was granted a location in the highway in 1872, and has since operated its cars therein and across the Old Colony Railroad, at grade.

In May, 1893, by chapter 368 of the Acts of that year, the Legislature authorized the county commissioners of Bristol County to rebuild the bridge between New Bedford and Fairhaven, and limited the expense thereof to \$200,000. The same act also authorized the commissioners to construct the approaches at a common grade with the railroad, should they deem it advisable, or to require the mayor and aldermen of New Bedford to institute proceedings under the grade crossings act, chapter 428 of the Acts of 1890, when the question would be left to the commission appointed by the superior court.

Under the authority of the act of 1893, the county commissioners caused plans to be made for both a grade and an overhead bridge. In 1894, by chapter 239 of the Acts, the Legislature authorized an increased expense of \$150,000, thereby limiting the cost to \$350,000, which was to be exclusive of land damages; and, upon petition of the citizens of Fairhaven and Acushnet, by chapter 530 of the Acts of that year, allowed a change in the eastern terminus of the bridge.

From 1894 to 1896 various plans were proposed for the abolition of a number of grade crossings in New Bedford, including the Bridge Street crossing, but the city and railroad were unable to agree on any plan.

On July 11, 1896, the county commissioners, after a number of hearings, decreed that in their judgment the public convenience and necessity required that the bridge should be constructed at grade with the railroad. In August, 1896, the commissioners awarded a contract for construction between Fairhaven and Fish Island, according to plans approved and decreed by them. At that time they were authorized to expend only \$350,000, exclusive of land and other damages. During the winter of 1896 and 1897, it was found that the appropriation heretofore made was insufficient, and the Legislature was asked to authorize an additional amount, which was given by chapter 200 of the Acts of 1897, making the total \$450,000.

During that year, owing to the requirements by federal authority for a draw with two openings, of 100 feet each in width, the county commissioners found that they would be unable to complete the bridge as they had planned (at grade) for the amount allowed by the Legislature, and asked for authority to spend more money. By chapter 387 of the Acts of 1898 they were authorized to expend for the total construction of the bridge, without damages, \$800,000, thereby increasing the original authority \$600,000, or 300 per cent. The same act would seem to confirm the action of the county commissioners in laying out the bridge at grade with the railroad. The original decree of July 11, 1896, estab-

lished the bridge at grade across Fish Island; but by a decree of the commissioners, May 23, 1898, following the fixed elevation of the draw, a new grade was determined, by which the roadway was raised an average of $7\frac{1}{2}$ feet across the island.

In January, 1899, a bill was presented to the Legislature, making it mandatory upon the county commissioners to construct the bridge and approaches thereto on the New Bedford side over the tracks, providing that the western approach should not be farther west than Acushnet Avenue, and that the difference in cost above that for a grade bridge should be apportioned under the grade crossing act of 1890. Said difference in cost would amount, for construction and including damages, probably \$700,000, making the total cost about \$1,500,000; and of this extra cost it was proposed to apportion 25 per cent. on the Commonwealth, 65 per cent. on the railroad and the balance on parties benefited, as provided in the original act.

Various amendments were proposed to this act, and toward the end of the session a new bill (Senate, No. 337) was proposed, which authorized the superior court to appoint a commission who were to have power to say whether the bridge should be built overhead or at grade, and to apportion the cost upon the Commonwealth, the railroad and the city. This bill was rejected, and the whole subject of completing the bridge was placed in the hands of the joint Board of Railroad Commissioners and Harbor and Land Commissioners, to report to the Legislature their findings.

A careful study of the legislation and the testimony submitted would seem to indicate that it was not the original intention to build such a structure as has already been erected, and the amount of money so far expended is far in excess of what public convenience and necessity required. At present, however, there exists a very expensive structure, now partially completed; and the citizens of New Bedford are not satisfied that the bridge shall end as was originally intended, but wish to have it carried farther into the city. This local sentiment is strong. It was apparent at the hearings before the joint Board, where, in the brief of counsel, it was suggested that the city was ready to bear an unusual portion of the expense pertaining to the overhead structure. Recent acts of the city council of New Bedford confirm this attitude.

The railroad crossing at the western location of the bridge is an extension from the New Bedford depot to the wharves, for the purpose of reaching their steamboat connections and to carry freight to and from private wharves, and is not used by express trains, and in this respect may be differentiated from the more important grade crossings on main lines. The danger, however, at this particular crossing is emphasized by the existence of an electric railway, which has practically secured an exclusive right of way across this bridge, and promises to become the New Bedford end of a growing system.

With this situation facing us, a difficult problem is presented. Danger is a word of as uncertain significance as there are minds to be affected by it. Few would have the hardihood to deny its existence at this crossing, or that with the passage of time and the growth of population and

business it would not materially increase, even if minimized for the present by restrictions and regulations.

The policy of the Commonwealth as to the separation of grade crossings is firmly established, as is its rule against permitting electric railways to cross steam railways at grade whenever it can be avoided. The large number of occasions in which, from various causes, electric cars become stalled while crossing steam railroad tracks, may be cited as testimony in confirmation of the wisdom of this rule. For this reason the Legislature has passed an act authorizing electric railway companies to take land for the purpose of constructing bridges over or ways under railroad locations.

In view, then, of the existence of a partially constructed bridge of magnificent proportions; of the strong sentiment in and demand of New Bedford that it shall be finished as an overhead structure across the railroad tracks, and avoiding Bridge Square as a terminal; of the existence of danger and inconvenience of a public grade crossing at this place; and of the added peril by reason of the presence of an electric railway, promising to be double tracked and the end of a system in the near future,—the joint Board has finally reached the unanimous conclusion to recommend the abolition of the public grade crossing at Bridge Street, and the construction of an overhead bridge. This will unavoidably leave a *private* crossing for the abutters between the railroad and the river, which will have to be preserved *as are the other private* crossings further to the south, and to this extent will prevent *the entire elimination of this grade crossing.*

III. *As to the Probable Expense thereof.*

It was early seen that the expense of carrying an overhead bridge structure, with proper approaches, into the city of New Bedford, would be very great. It was fully recognized that the expenses thus far incurred are in many quarters deemed most lavish and extravagant, have become a subject of general comment and stricture, and excited apprehension on the part of tax payers; and that the city of New Bedford, however much her citizens might desire to have this work carried out to completion on the scale upon which it had begun, could not disregard the fact that she already was burdened with a heavy tax rate.

Several plans were presented to the joint Board. One contemplated beginning at the east side of Fish Island, and ending at Second Street. Two other plans were shown,—one more and one less expensive to build. The first of these latter plans would involve the payment of additional grade damages on Fish Island, and a large amount on the New Bedford side. This was urged, as affording the finest approach into the city of New Bedford, as comporting with the dignity and character of the entire bridge structure, and as creating an opportunity for advantageously widening adjacent streets and furnishing a boulevard for the embellishment of the city. Estimates were given of the cost at from \$642,000 to \$750,000. It seemed to the Board that something satisfactory from the esthetic as well as the utilitarian point of view could be accomplished at considerably less cost; and after due deliberation it

was concluded that an elevated structure, 70 feet wide, to begin at the west side of Fish Island, and rising at a grade of less than 3 per cent. to an elevation over the railroad track that would give 16 vertical feet in the clear for car space underneath, and thence descending, by a grade not to exceed 3 per cent., to Water Street, would meet and fulfill all the requirements of the situation.

As no appropriation for furnishing the Board with the services of an expert bridge engineer to deal with this purely technical problem of architectural engineering had been provided, the joint Board was obliged to rely largely upon gratuitous advice and assistance in making this estimate.

The joint Board is of opinion that the total expense, including land and grade damages, of completing the way as already laid out across Fish Island, and of constructing an overhead bridge, beginning at the western end of Fish Island, crossing the channel and the railroad and landing at Water Street, ought not to exceed the sum of \$450,000. This estimate, while large, is not calculated to provide for any further payments of damages excessively disproportionate to assessed valuation.

IV. By whom should the Work be done?

In view of the extravagant expenditure of public money by the county commissioners, and the fact that the remaining portion of the bridge to be built is within the limits of New Bedford, it seems proper to suggest that city as the most fitting and suitable party to proceed with the completion of the undertaking. It is for her interest that it should be done as economically as may be, for on her will fall a great part of the burden. She will also be better able to provide for and adjust the approaches through her streets to meet the termination of the bridge proper within her limits.

The railroad company disclaims any desire to build that portion of the structure to be erected within the lines of the railroad location, but is willing that it should be done by the city. Furthermore, the other parties interested will be watchful for careful and economical expenditures.

It is accordingly recommended that the city of New Bedford be the party by whom the work should be done.

V. By what Parties the Expense thereof should be borne and paid.

In view of all the foregoing and of the peculiar conditions which exist, and of the unusual character and proportions of the bridge, and also of the fact that a *private crossing with its attendant expense and dangers is left for the railroad company to deal with as best it may*, it is obvious that it would be unjust to expect the Commonwealth and the railroad company to pay more than an equitable proportion of the cost of abolition. Such deviation from the grade crossing act of 1890 has been recognized when special conditions have called for apportionment of cost adapted to the peculiar circumstances of the case.

The city of New Bedford presents no claim to be exempt from bearing her full share of a great improvement, from which, more than all other parties, she will derive benefit and satisfaction.

The Union Street Railway Company would be the recipient of benefits from the proposed elevated structure that would justify charging to it a portion of the expense thereof. The Union Street Railway Company has secured privileges from New Bedford, Fairhaven and the county commissioners, with a view of being confirmed in exclusive occupation of this bridge with its railway. Without discussing the scope or validity of these privileges, there is little doubt of a continuance of its possession of an exclusive location over the bridge. Street railway accommodation is needed, and so long as it is given by this company it is not likely that any disturbance of occupation will take place. The bridge was widened in order to give space for the tracks of the railway without incommoding other traffic.

The Legislature has recognized by general laws and by special enactments the propriety of imposing upon street railways, under special conditions, a portion of the expense of public improvements by which they were particularly to be benefited.

The joint Board feels justified, in this case, in recommending that the Union Street Railway Company be assessed a fair percentage of the cost of all the New Bedford end now remaining to be built.

The town of Fairhaven would receive a distinct, special benefit from its abolition, and therefore should bear a part of the expense.

The expense already incurred in building the bridge from the Fairhaven shore to Fish Island is too great to justify the suggestion that any towns in Plymouth County be charged with a contribution larger than is limited by chapter 460 of the Acts of 1899.

While the resolve does not in words require a report on the proper apportionment of the expense upon the parties by whom it should be borne and paid, nevertheless, considering the true purpose and intent of the resolve, it is believed that the report would be considered incomplete unless a recommendation to that effect were included. Indeed, to fix the proportions is but a step beyond discriminating the parties.

The joint Board has estimated that an expense of completing the bridge, in the manner hereinbefore recommended, by an overhead structure, ought not to exceed \$450,000. The estimate of \$220,000 for completing the bridge at grade has been given by other reliable authority. The difference between these two amounts, that is, the sum of \$230,000, would seem, then, to be properly chargeable to the overhead structure, and to be the sum fairly to be apportioned by this report. As, however, this sum is but an estimate, and liable to variation, it is recommended that the expense of that portion of the bridge under consideration, whatever it may ultimately be found to be, shall be divided and paid as follows:—

The Commonwealth to pay 12 per cent., in no event to exceed	\$30,000
The New York, New Haven & Hartford Railroad to pay 33 per cent., in no event to exceed	90,000
The Union Street Railway Company to pay 10 per cent., in no event to exceed	25,000
The town of Fairhaven to pay 5 per cent., in no event to exceed	12,500
The city of New Bedford to pay the balance.	

The sum of \$220,000 which is the estimate for finishing the bridge at grade is left to be apportioned under the terms of the original bridge act.

It is further suggested that any bill drafted in pursuance of these recommendations should contain provision to secure an application of the betterment law in all suits brought for damages to private property.

WOODWARD EMERY, *Chairman,*

JAMES F. JACKSON,

GEORGE W. BISHOP,

HERSEY B. GOODWIN,

Board of Railroad Commissioners.

CLINTON WHITE,

CHARLES C. DOTEN,

Board of Harbor and Land Commissioners.

And whereas, by chapter 439 of the Acts of the year 1900, entitled "An Act relative to the relocation and completion of the bridge over the Acushnet River between the city of New Bedford and the town of Fairhaven," it was enacted as follows, viz. :—

SECTION 1. The board of railroad commissioners and the board of harbor and land commissioners, who for this purpose are constituted a joint board to act by a majority vote of all the members thereof, shall prescribe the manner in which so much of the highway, bridge and the approaches thereto, between the city of New Bedford and the town of Fairhaven, as has not been constructed by the county commissioners of the county of Bristol, under the provisions of chapter three hundred and sixty-eight of the acts of the year eighteen hundred and ninety-three, and all acts in amendment thereof and in addition thereto, shall be constructed and completed, and, except as herein otherwise provided, maintained by the city of New Bedford, from the east side of Fish Island to the east line of Water street, *in accordance with the recommendations and report of said joint board to the general court of the year nineteen hundred, and in accordance with plans, specifications and requirements to be adopted and approved by said joint board, and by them duly filed in the registry of deeds for the county of Bristol, southern district;* and said city in the construction and completion thereof, as thus prescribed, shall exercise all the powers and perform all the duties pertaining thereto imposed upon said county commissioners by said acts, not inconsistent therewith.

SECTION 2. The city of New Bedford is hereby authorized and directed to locate and lay out anew said bridge and the approaches and way leading thereto, *in the manner prescribed by said joint board*, and to take therefor, by purchase or otherwise, the private property of persons and corporations, as provided in section four of chapter three hundred and sixty-eight of the acts of the year eighteen hundred and ninety-three, in relation to the taking of lands by the said county commissioners. All proposals for bids for the construction of the whole or any portion of said bridge by said city shall be expressed therein, to be subject to the right of said city to reject any and all bids not approved in writing by said joint board.

And whereas, due notice was given to all parties interested by said joint Board, of the time and place of hearing, at which time and place the city of New Bedford was represented by the Hon. Charles S. Ashley, mayor of the city of New Bedford, William F. Williams, city engineer, and Thomas F. Desmond, special counsel for said city; the Old Colony Railroad Company by the Hon. J. H. Benton; the Union Street Railway Company by the Hon. C. W. Clifford and Oliver Prescott, Jr., Esq.; the owners of Parker's block by said C. W. Clifford; the firm of Garfield & Proctor by said C. W. Clifford; and the firm of Anthony, Swift & Co. by Freedom Hutchinson.

Now, therefore, after due notice to all parties interested, and hearing given to all parties interested, present and desiring to be heard; it was unanimously —

Voted, That we, the Board of Railroad Commissioners and the Board of Harbor and Land Commissioners, sitting as a joint Board, in pursuance of the provisions of chapter 439 of the Acts of the year 1900, do hereby “prescribe the manner in which so much of the highway, bridge and the approaches thereto, between the city of New Bedford and the town of Fairhaven as has not been constructed by the county commissioners of the county of Bristol under the provisions of chapter 368 of the Acts of the year 1893, and all acts in amendment thereof and in addition thereto, shall be constructed and completed, and, except as otherwise provided by chapter 439 of the Acts of the year 1900, maintained by the city of New Bedford from the east side of Fish Island to the east line of Water Street, in accordance with the recommendations and report of the joint Board to the General Court of the year 1900,” as follows: —

I. We prescribe the construction of an overhead bridge from the east side of Fish Island to the east line of Water Street in the city of New Bedford, in the manner hereinafter provided, but upon the condition that there shall be reserved upon and over the location and tracks of the railroad company, for the benefit of the estates abutting upon Bridge Street between the railroad and the river, an open crossing at grade, free from the obstruction of gates or bars, to be planked and maintained by the railroad company for the time being in possession.

II. We prescribe that the existing way leading from the river to Bridge Square, except as to that portion within the location of the railroad, shall be forever maintained and kept in repair by the city of New Bedford as an approach to the bridge for the benefit of the estates abutting thereon; and that the bridge over said existing way shall be constructed with due regard to convenient

access for ordinary traffic to and from the abutting estates, in accordance with the plans and specifications for building the bridge approved by the joint Board.

III. We prescribe the construction and completion of so much of the highway, bridge and approaches thereto between the city of New Bedford and the town of Fairhaven as lies between the east line of Water Street and the east side of Fish Island upon and over the following described location, viz.: the north line begins at a point in the east line of Water Street seventy (70) feet northerly in said east line from the north line of Middle Street, thence easterly in a straight line parallel to and seventy (70) feet distant from the north line of Middle Street, one hundred fifty-six and seven hundredths (156.07) feet; thence in a curve whose radius is fifty (50) feet and angle of intersection twenty-one degrees, thirty-three minutes, fifteen seconds ($21^{\circ} 33' 15''$) to the north, eighteen and eighty-one hundredths (18.81) feet; thence in a straight line tangent to said curve, sixty-two and three hundredths (62.03) feet to a boundstone called "number one" in the New Bedford bridge decree of the county commissioners of Bristol County, dated July 11, 1896; thence in a continuation of the same line easterly one hundred fifty-two and nine tenths (152.9) feet to a boundstone called in said decree "number two," in the east line of the location of the Old Colony Railroad; thence deflecting to the south four degrees fifty-one minutes ($4^{\circ} 51'$) and in a straight line five hundred nineteen and fourteen hundredths (519.14) feet to a point in the west shore of Fish Island; thence deflecting to the north one degree six minutes ($1^{\circ} 6'$) and in a straight line four hundred forty-seven and ninety-six hundredths (447.96) feet to the east face of the parapet of the present masonry abutment on the east shore of Fish Island; thence southerly across the bridge in the line of the face of said abutment seventy (70) feet; thence the southerly line runs westerly in a straight line parallel to and seventy (70) feet distant from the above-described north line, four hundred forty-eight and sixty-three hundredths (448.63) feet; thence deflecting to the north one degree six minutes ($1^{\circ} 6'$) and in a straight line parallel to and seventy (70) feet distant from said north line, five hundred sixteen and eighty-five hundredths (516.85) feet; thence deflecting to the south four degrees fifty-one minutes ($4^{\circ} 51'$) and in a straight line parallel to and seventy (70) feet distant from the above-described north line, one hundred forty-nine and ninety-four hundredths (149.94) feet to a point at right angles to boundstone number one; thence continuing in the same line eighty-four and eighty-six hundredths (84.86) feet to a point in the north line of Middle Street; thence westerly in the north

line of Middle Street one hundred seventy-nine and four hundredths (179.04) feet to the east line of Water Street; thence northerly in the east line of Water Street seventy (70) feet to the point of beginning.

So much of the above described location as lies east of boundstone "number one," aforesaid, being in exact conformity to the location as described by the said decree of the county commissioners, and all the metes and bounds thereof being the same as established by said decree, that part of said location lying west of said boundstone "number one" shall be taken and laid out by the city of New Bedford, under the provisions of chapter 439 of the Acts of 1900.

IV. We prescribe the grades at which the bridge and the approaches thereto shall be constructed to be as follows, to wit: the grade of the surface of the pavement on the middle line thereof shall begin at the New Bedford approach on the east line of Water Street at an elevation of ten and ninety-four hundredths (10.94) feet above the New Bedford city base; thence the grade runs by an ascending grade easterly not exceeding three (3) feet per one hundred (100) feet for three hundred seventy-eight and twenty-eight hundredths (378.28) feet to elevation twenty-two and three tenths (22.3) feet; thence in a vertical curve whose highest elevation is twenty-two and thirty-five hundredths (22.35) feet, a distance of eleven and seventy-five hundredths (11.75) feet to elevation twenty-two and three tenths (22.3) feet; thence by a descending grade of three (3) feet per one hundred (100) feet, ten (10) feet to elevation twenty-two (22) feet; thence by a descending grade of two and twenty-one hundredths (2.21) feet per one hundred (100) feet, four hundred seventy-nine and fifty-six hundredths (479.56) feet to elevation eleven and four tenths (11.4) feet; thence by a vertical curve a distance of eighty (80) feet to elevation ten and seventy-seven hundredths (10.77) feet on the west shore of Fish Island, which is the elevation established by the decree of the county commissioners dated May 23, 1898, as the grade of the bridge at this point; thence by the grade established by said decree of May 23, 1898, which is an ascending grade of six hundred sixty-nine thousandths (.669) of a foot per one hundred (100) feet, to elevation thirteen and five tenths (13.5) feet at the face of the parapet of the present abutment on the east side of Fish Island. The grade of the northerly and southerly curbs of said approaches and bridge are the same as above described for the surface of the pavement at the middle line of said approaches and bridge, except where it may be necessary to modify them in order that the curbs may be at the same elevation on opposite sides of the roadway. The grade of

the top of the coping of retaining walls and the top of the fascia of metal work is three (3) inches above the grade of the curbs.

The grade of that portion of the surface of the ground within the lines of the bridge location and beneath the metal work of the overhead bridge, from the abutment near the west line of Front Street to the abutment on the New Bedford shore, shall be as follows: beginning at the east face of said abutment near the west line of Front Street at an elevation of five (5) feet above said city base, thence easterly by a descending grade to elevation four (4) feet at the west line of the location of the Old Colony Railroad, which is the present elevation of the tracks of said railroad; thence across said location at a level grade; thence easterly from elevation four (4) feet at the east line of said location by an ascending grade to an elevation of five (5) feet at the west side of the New Bedford shore abutment.

The location and grades of said bridge and approaches are shown on a plan verified by the signatures of the joint Board, entitled "Location and grades of the New Bedford and Fairhaven bridge."

V. We prescribe that said highway, bridge and approaches as above described shall be constructed within the location and at the grades above described in the manner following:—

First. — That portion thereof from the east line of Water Street easterly for a distance of one hundred eighty-four and thirty-one hundredths (184.31) feet, measured on the centre line of said location, shall have masonry retaining walls on the north and south lines and a masonry abutment at the easterly end, the space within said walls and abutment to be filled solid with suitable filling.

Second. — That portion from the abutment just described to an abutment forty (40) feet west of the west shore of Fish Island shall consist of a bridge or metal superstructure of thirteen (13) deck spans of steel plate girders resting on three (3) masonry piers, three (3) masonry abutments and thirty-two (32) steel posts. That portion thereof over the location and tracks of the Old Colony Railroad Company shall be constructed so as to provide a clear height of sixteen (16) feet from the top of rails of said tracks to the lowest portion of the steel work above said tracks for a width of not less than twenty-five (25) feet. The clear distance between the steel posts supporting the metal span over said location and tracks shall be not less than thirty (30) feet.

Third. — That portion from an abutment forty (40) feet west of the west shore of Fish Island to the present abutment on the east shore of Fish Island shall have masonry retaining walls on the north and south lines; the space within said walls and abut-

ments to be filled with suitable filling. The roadway for the entire structure from the east line of Water Street to the east side of Fish Island shall not exceed fifty-four (54) feet in width, and shall be paved with vitrified paving brick on a concrete base, and curbed with granite on the solid fill sections and with steel on the metal work. There shall be a sidewalk on each side of the roadway not exceeding eight (8) feet in width, with a cement concrete surface commonly known as "granolithic." There shall be an iron railing of suitable design on both sides of the bridge, and approaches set on top of retaining walls and outer fascia girders of metal work.

Fourth. — That portion of the present surface beneath the metal structure within said location from the abutment near the west line of Front Street to the west line of the location of the Old Colony Railroad shall be paved with granite blocks for a width of forty-seven (47) feet, with tar concrete sidewalks and granite curbing. That portion of the surface beneath the metal structure within said location from the east line of the location of the Old Colony Railroad to the New Bedford abutment shall be graded with coarse gravel to the grades described.

Details of construction of said bridge and approaches are shown on nine plans thereof, numbered 1, 2, 3, 4, 5, 6, 7, 8 and 9, and verified by the signatures of the joint Board, dated Jan. 25, 1901, and made a part of this decree.

VI. We prescribe that the highway, bridge and the approaches and ways leading thereto and the ways underneath the same as hereinbefore set forth shall be constructed and completed as to location, grades and manner, in strict compliance with all the requirements herein and as set forth in detail in the plans and specifications aforesaid adopted and approved by this joint Board, and made part hereof; and that all the same, together with this order, forthwith shall be filed in the registry of deeds for the county of Bristol, southern district, by said city of New Bedford, all in accordance with the provisions of chapter 439 of the Acts of 1900.

JAMES F. JACKSON,
GEORGE W. BISHOP,
HERSEY B. GOODWIN,

Board of Railroad Commissioners.

WOODWARD EMERY,
CLINTON WHITE,
CHAS. C. DOTEN,

Board of Harbor and Land Commissioners.

On January 25 the joint Board, after considering four proposals for the foundation, masonry and roadway, and eleven proposals for the metal work for the completion of the bridge and highway between the east line of Water Street and the east side of Fish Island, submitted by the mayor of New Bedford as received by his city in response to advertisements, approved the action of the city in passing the following votes : —

Voted, That the joint Board of Railroad Commissioners and Harbor and Land Commissioners, acting under the provisions of chapter 439 of the Acts of the year 1900, having listened to the report of a committee of the city council of the city of New Bedford, to whom was referred the question of the approval of the contract between the city of New Bedford and the American Bridge Company for furnishing and erecting the metal work for the completion of the New Bedford and Fairhaven bridge for the sum of \$94,540, presented to said joint Board on Jan. 25, 1901, by the mayor of the city of New Bedford, do hereby approve the action of said committee in recommending said city to execute the contract aforesaid with the American Bridge Company, and hereby approve the acceptance of said bid by said city.

Voted, That the joint Board of Railroad Commissioners and Harbor and Land Commissioners, acting under the provisions of chapter 439 of the Acts of the year 1900, having listened to the report of a committee of the city council of the city of New Bedford, to whom was referred the question of the approval of the contract between the city of New Bedford and Miller & Ellis, for the sum of \$152,865, for the foundation, masonry and roadway construction of the New Bedford and Fairhaven bridge, presented to said joint Board on Jan. 25, 1901, by the mayor of the city of New Bedford, do hereby approve the action of said committee in recommending said city to execute the contract aforesaid with Miller & Ellis, and hereby approve the acceptance of said bid by said city.

On February 7 the joint Board approved the contracts executed in pursuance of the foregoing, then submitted, and also the surety for the performance thereof, as appears by the following votes and endorsements : —

It was unanimously *Voted*, That the joint Board established under the provisions of chapter 439 of the Acts of 1900 hereby approves the contract and specifications for the construction of

foundations, retaining walls, piers, abutments, roadway, pavements, sidewalks and other fixtures, required for the construction of the New Bedford and Fairhaven bridge, from the east line of Water Street to the east side of Fish Island, exclusive of the "metal work," dated Feb. 4, 1901, and executed by and between the city of New Bedford and William L. Miller & William H. Ellis, for the sum of \$152,865; also bond in the sum of \$38,217, annexed to said contract.

It was unanimously *Voted*, That the joint Board established under the provisions of chapter 439 of the Acts of 1900 hereby approves the contract for furnishing and erecting the metal work required in the construction of the New Bedford and Fairhaven bridge from the east line of Water Street to the east side of Fish Island, dated Feb. 4, 1901, and executed by and between the city of New Bedford and the American Bridge Company for the sum of \$94,540; also bond in the sum of \$23,635, annexed to said contract.

The following endorsement was made on each of the said contracts: —

COMMONWEALTH OF MASSACHUSETTS.

SUFFOLK, SS.

At a meeting of the joint Board of Railroad Commissioners and Harbor and Land Commissioners, held under the provisions of chapter 439 of the Acts of 1900, at Room 130, State House, Boston, on Thursday, Feb. 7, 1901, all the members being present, it was unanimously voted to approve the within contract and bond.

FREDERICK N. WALES,
Clerk of the joint Board.

At a subsequent meeting of the joint Board, the appointment of William F. Williams to be chief engineer of the New Bedford and Fairhaven bridge, at a stated salary, was approved, as was also his charge for services relating to the bridge up to Jan. 1, 1901.

On June 5 the joint Board met, and the following votes were passed: —

Voted, That the letter of William F. Williams, chief engineer of the New Bedford and Fairhaven bridge, dated May 22, 1901, and addressed to Miller & Ellis, the contractors, ordering extra work upon said bridge to the amount of \$1,065.35, is hereby approved.

Voted, That the acceptance by the city of New Bedford, on May 21, 1901, of the proposal to said city made through Chambers & Hone of New York, of the Pittsburgh Testing Laboratory, Limited, for the inspection of the mill and shop work on the metal work required in building the New Bedford and Fairhaven bridge, under chapter 439 of the Acts of 1900, at a price of 30 cents per net ton of 2,000 pounds for mill inspection and 35 cents per ton for shop inspection, be and hereby is approved.

On November 1 the joint Board met for the purpose of considering the propriety of extra work in the construction of the abutments and piers of the water section; and, after a full hearing and careful investigation, unanimously

Voted, That the letter of William F. Williams, chief engineer of the New Bedford and Fairhaven bridge, dated Sept. 1, 1901, to Miller & Ellis, the contractors, ordering extra work upon said bridge to the amount of \$4,208, and approved by the mayor of the city of New Bedford, is hereby approved.

CAPE COD CANAL.

On Dec. 6, 1900, the Board gave a hearing relative to approval of plans of location and construction of a canal from Buzzards Bay to Barnstable Bay, by the Boston, Cape Cod & New York Canal Company, which plans had been filed Sept. 28, 1899.

On Jan. 16, 1901, the joint Board met at the request of counsel for the canal company, who submitted the following forms: (1) advertisement for bids; (2) information for bidders; (3) proposals; (4) contract; (5) specifications for jetties; (6) specifications for excavation; (7) specifications for drawbridges; (8) mortgage, — and asked the Board to approve them.

On January 17 the Board received a petition from the company for approval of plans for building structures at the entrance to the canal in Barnstable Bay, issued an order of notice, and on January 22 heard the parties interested. At the close of the hearing the matter was taken under consideration, and subsequently it was voted to issue a license in accordance with the petition upon the filing of certain plans; which, however, have not as yet been filed.

On January 23 the Board met with the Railroad Commis-

sioners as a joint Board, and again listened to the counsel for the canal company relative to the form of documents theretofore filed; but it was obviously unsuitable for the joint Board to be asked to take action before the plans for the construction of the canal had been adopted.

On February 5 the following letter was sent to the Attorney-General:—

FEB. 5, 1901.

Hon. HOSEA M. KNOWLTON, *Attorney-General of the Commonwealth, State House, Boston*

SIR:—One or two questions have arisen on the construction of chapter 448, Acts of 1899, and the Board would like your advice as to the correct interpretation thereof.

Section 4 requires the Boston, Cape Cod & New York Canal Company to “file with the Harbor and Land Commissioners a plan of the proposed location and a plan of the proposed construction thereof,” which has been done within the time required; and then says: “The plan so approved or modified, being accepted by said company, shall be deemed to be the plan of the location and construction of said canal, and said company shall be authorized to construct its canal in accordance therewith.” Later, in section 6, the statute says: “Said canal company shall construct its canal with such structures and appliances for its protection and use as said joint Board may order, together with such bridge or bridges, tunnel or tunnels, ferries and changes of highways, under the supervision of said joint Board, as shall be in accordance with plans approved by them and in conformity with such orders as they may make.”

The question upon which advice is desired is: Should this Board, under section 4, approve a plan of construction which did not include a lock, or locks, or gates, would it be in the power of the joint Board, under section 6, to order such structures to be built?

Yours respectfully,

WOODWARD EMERY,
Chairman.

On February 12 the following opinion was received from the Attorney-General:—

BOSTON, Feb. 11, 1901.

Hon. WOODWARD EMERY, *Chairman, Harbor and Land Commission, Boston, Mass.*

DEAR SIR:—The charter of the Cape Cod Canal, Statutes of 1899, chapter 448, provides, in section 4, that the corporation shall file with your Board “a plan of the proposed location and a

plan of the proposed construction thereof." It is the duty of the Board thereupon to hear the parties, require such modification, if any, as it may desire, and to approve the plans as filed or as modified.

Section 6 provides that the joint Board of Harbor and Land Commissioners and the Railroad Commissioners shall "determine at what point or points the railroad of the Old Colony Railroad Company shall cross said canal by a drawbridge or bridges, or by a tunnel or tunnels constructed under said canal." The section further provides that the canal company shall construct its canal "with such structures and appliances for its protection and use as said joint Board may order, together with such bridge or bridges, tunnel or tunnels, ferries and changes of highways, under the supervision of said joint Board, as shall be in accordance with the plans approved by them and in conformity with such orders as they may make."

The precise question submitted by your letter of February 5 is as follows: "Should this Board, under section 4, approve a plan of construction which did not include a lock, or locks, or gates, would it be in the power of the joint Board, under section 6, to order such structures to be built?"

I very much doubt whether your Board has the right to my opinion upon the question submitted. It is rather for the joint Board, if a situation arises before that Board which will make it material. But it may not be amiss for me to submit my views as to the duty of your Board under section 4, above quoted. It imposes, in my opinion, upon your Board the duty of determining in what manner the canal shall be constructed. This includes all questions relating to locks, tide gates and such other structures. You are to have in view the use of the canal for purposes of navigation, and to determine what method of construction will be the safest and most convenient in view of all the facts and probabilities, including the probable rate of tide in the canal, and how far its current may make navigation dangerous if unrestrained by structures intended to prevent such movement.

You have no means of knowing, of course, whether the joint Board will order the crossing in question to be effected by a tunnel or a bridge; but I assume that it is not unreasonable for you to anticipate that bridges, either for the railroad or for highways, will be necessary. In all events, the question of such probability is before you, and it is your duty to order the construction of the canal in such manner as will provide for all these circumstances and probabilities. The determination, therefore, of the question of locks and gates is confided to the discretion of your Board.

The obvious purpose of section 6 is to submit to the joint Board all questions concerning the crossing of the canal by the railroad company. These questions are submitted to the joint Board rather than to your Board, for the reason that they involve on the one hand the considerations affecting railroad transportation, and navigation on the other.

The precise question whether the joint Board will have jurisdiction to order the construction of locks, in case you shall have approved plans which do not call for such structures, is one which does not concern, in my judgment, your duty under section 4, and which may well be determined when, if ever, it arises.

Yours very truly,

HOSEA M. KNOWLTON,
Attorney-General.

On February 26 the Board, after various and sundry conferences and consultations with the engineers both of the Board and of the company, and after hearing its counsel with reference to requiring a lock in the canal, passed the following votes in regard to plans and modifications thereon:—

Voted, That the plans filed with the Board of Harbor and Land Commissioners, Sept. 28, 1899, by the Boston, Cape Cod & New York Canal Company, under section 4 of chapter 448, Acts of 1899, are, in the public interest, after public notice and hearing, by virtue of the provisions of said act, hereby required to be modified as follows, to wit:—

MODIFICATIONS REQUIRED BY THE BOARD OF HARBOR AND LAND COMMISSIONERS IN THE PLANS SUBMITTED BY THE BOSTON, CAPE COD & NEW YORK CANAL COMPANY.

Location Plan.

The plan of location should show the exact situation of certain highways and bridges which now exist on the location of the canal, not shown on the plans. The shore lines and some small details at the westerly end of the canal should be altered to conform to the present conditions. The location of the westerly end of the canal shall be changed and delineated on the plan so as to conform to the plan hereto annexed, which is in substantial accordance with the statement of the engineer of the canal, as made at the hearing. In addition to the bearings written along the centre line of the canal, an arrow showing the meridian should be placed on each sheet. All to be to the satisfaction of the Board, so that the location may be sufficiently accurate for identification.

Construction Plans.

1. The plans must show the entire wetted perimeter throughout the length of the canal protected from erosion by stone or some similar indestructible material, except where the material through which the canal is excavated is of such a nature as not to be liable to erosion by the currents which are expected to flow through it.

From about 3 feet below mean low water to about 3 feet above mean high water the protective covering on the banks must be sufficient to prevent erosion from the waves created by passing vessels.

Profile.

2. The profile along the centre line of the proposed canal must, in addition to the elevations of the present surface of the ground and of the bottom of the canal, exhibit, so far as is known, the kind, location and extent of the various classes of material through which the canal is to be built.

All the elevations, so far as is practicable, must be marked on the plan in figures.

The kinds of material indicated must be described on the plan as accurately as may be in a few words.

Structural Plans.

3. One plan must show the centre line of the canal with the various bottom widths and the locations where they occur, including four meeting places for passing vessels, to be located at or near stations 112-190-328 + 50 and 380 on the plans heretofore filed. At these stations the canal to be not less than 300 feet wide on the bottom, this width to be gradually reduced on both sides of said stations, until at a distance of from 1,600 to 1,800 feet it reaches the standard bottom width of the canal at that point. It must also show the location of the various cross-sections described below.

Other plans must show enough cross-sections in detail at various points throughout the canal wherever material variations occur either in dimensions or method of construction, with verbal description where necessary.

The dimensions of the various parts must be placed on the plan in figures.

In General.

All information necessary to ascertain how and where the canal is to be constructed, without the aid of other specifications, must be placed upon the plans. The plans should be in sheets of a standard size, so that they may be bound in two atlases. The

detail upon the various plans must be sufficient to satisfy the Board.

A title page should be added to each atlas, stating what the plans are, by whom filed, scale, date and all necessary explanatory notes, to be identified by the signature of the engineers or some officer of the canal company.

The question of locks is one relating to structures and appliances for the protection and use of the canal, and consequently must be passed upon by the joint Board, under section 6, chapter 448, Acts of 1899.

A copy of the foregoing was forwarded to the Boston, Cape Cod & New York Canal Company, to which the following reply was received:—

Boston, Feb. 27, 1901.

The Board of Harbor and Land Commissioners, State House, Boston, Mass.

GENTLEMEN:—We beg to acknowledge the receipt of a copy of the votes of the Board, passed on the 26th inst., and forwarded us by the clerk of the Board, pursuant to your resolution, and in part entitled, “Modifications required by the Board of Harbor and Land Commissioners in the plans submitted by the Boston, Cape Cod & New York Canal Company.”

We have submitted the same to the engineer of the company for examination, requiring a reply from him to certain questions which are fully set forth in his letter, a copy of which we have the honor to enclose herewith.

In view thereof, we believe that the modifications required are acceptable to the canal company, and the same will be prepared as rapidly as possible.

Respectfully,

BOSTON, CAPE COD & NEW YORK CANAL COMPANY,
By WALTER CLIFFORD,

Clerk.

FEB. 28, 1901.

Boston, Cape Cod & New York Canal Company, 301 Tremont Building, Boston, Mass.

GENTLEMEN:—Replying to the questions referred to me by you, —“First, are the modifications required by the Board of Harbor and Land Commissioners to be made by the canal company in its plans, modifications which will increase the efficiency and availability of the canal, with reasonable regard to economy in construction? Second, how long will it take to prepare modified

plans in accordance with the requirements of the Board?" — I submit the following:—

Referring to the communication from the Board, dated the twenty-sixth day of February, 1901, I am of the opinion that the modifications required are to the best interests of the canal, for they will tend to maintain its permanency and facilitate its operation.

Apart from mere questions of detail in the modified plans, the substantial recommendations are: (a) The change of the line at the Buzzard's Bay end of the canal, which I have already recommended to the company. (b) The widening of the canal at the points where it is crossed by the bridges, which I have equally commended. It seems to me that this last modification is a wise one, as by such widening the velocity of the current at those points will be about halved, with a tendency to reduce by irregularity of sections the velocity throughout the canal. (c) The modifications requiring that the plans show the entire wetted perimeter throughout the length of the canal protected from erosion, by stone or other similar indestructible material, *except* where the material through which the canal is excavated is of such nature, in part or in whole, as not to be liable to erosion by the currents which are expected to flow through it. This requirement is entirely proper in principle, although there might be some question as to where and to what extent this protection is necessary. From my interview with Mr. Hodgdon, the engineer of the Board, I infer that the Board intends this to be treated from a practical standpoint, and does not intend that we shall provide for work which would be of doubtful utility, and can be done later if found necessary. Lastly, (d) as to wave protection,—the only additional modification that I would suggest is that where needed it be carried 5 feet below and above mean low and high water, instead of 3 feet, as required by the Board.

Referring to your second question, it may take some time to prepare the modified plans, as required by the commissioners. I find, however, that we have on hand sufficient blue-prints of plans made from time to time to enable us, with some slight additions and changes, to furnish the Board with provisional modified plans, sufficient for all present purposes.

Respectfully submitted,

A. L. RIVES,
Chief Engineer.

On March 14 the joint Board met, and it was decided to ask the opinion of the Attorney-General upon certain legal questions submitted in the following letter:—

MARCH 14, 1901.

HON. HOSEA M. KNOWLTON, *Attorney-General, Boston, Mass.*

DEAR SIR: — The joint Board of Railroad and Harbor and Land Commissioners met to-day to take up their duties under the recent statutes relating to the construction of a canal between Buzzard's Bay and Barnstable Bay.

At the outset we find a legal problem which we desire to submit to you.

The Board of Harbor and Land Commissioners *having approved plans* for the construction of this canal without having determined the necessity of locks, does the joint Board have jurisdiction over that question, under the provisions of section 6, chapter 448, Acts of 1899, upon the theory that it should consider locks as a structure or appliance required for the protection and use of the canal?

It has occurred to us that even although, as you have decided, the Board of Harbor and Land Commissioners had the right to pass upon the question of locks, nevertheless, that Board not having passed upon it, and having approved plans without reference to locks, the joint Board ought to take up that matter, upon the theory that the lock is a structure or appliance necessary for the protection and use of the canal.

Before proceeding, we would like to know what your views are upon this point, in view of the fact that an opinion has already been rendered which might seem to preclude the joint Board from passing upon this question.

Yours very truly,

JAS. F. JACKSON,
Chairman, Joint Board.

On April 11 the joint Board met in conference for the purpose of reading the reply of the Attorney-General, which is as follows: —

BOSTON, April 6, 1901.

HON. JAMES F. JACKSON, *Chairman, Board of Railroad Commissioners, Beacon Street, Boston, Mass.*

DEAR SIR: — Your letter of March 14 states that the plans of the Boston, Cape Cod & New York Canal Company have been approved by the Board of Harbor and Land Commissioners, in accordance with the provisions of the charter of the company (Statutes of 1899, chapter 448, section 4), and are now before the joint Board of Harbor and Land Commissioners and the Railroad Commissioners, for action by the Board under the provisions of section 6 of the same statute. Your letter further states that the Board of Harbor and Land Commissioners approved the plans

"without having determined the necessity of locks," and requires the opinion of the Attorney-General upon the question whether, in view of that fact, the joint Board has jurisdiction of the question of locks.

The jurisdiction of the joint Board is, in my judgment, in no way dependent upon the action of the Board of Harbor and Land Commissioners. The charter in separate sections (4 and 6) clearly points out the duties devolving upon each Board, and the authority and responsibility of each Board is to be found in those provisions. Yours is not a board of appellate but rather of original jurisdiction.

In a letter to the Board of Harbor and Land Commissioners, dated Feb. 11, 1901, I pointed out what appeared to me to be the duties of that Board in these words: "You are to have in view the use of the canal for purposes of navigation, and to determine what method of construction will be the safest and most convenient in view of all the facts and probabilities, including the probable rate of tide in the canal, and how far its current may make navigation dangerous if unrestrained by structures intended to prevent such movement."

To these views, after the re-examination made necessary by the request of your Board for an opinion, I still adhere. The scheme of the statute, although not always expressed in the clearest terms, appears to me to be as follows: the company chartered must, within four months, file with the Harbor and Land Commissioners a plan of the proposed location and "a plan of the proposed construction thereof." I see no reason to doubt that the word "construction" necessarily includes and was intended by the Legislature to include all things appertaining to the construction of the canal, including the question of locks, which, I take it, is one of the most important questions touching the construction of a canal.

Before filing such plans, the company must deposit with the Treasurer of the Commonwealth the sum of \$200,000, to be held as security for the payment of damages occasioned by the taking of land. If the plans are not approved by the Board of Harbor and Land Commissioners, or if the modifications ordered by them are not acceptable to the company, it may withdraw its deposit and forfeit its rights under the charter (section 23). But if, on the other hand, it is content with the plans of location and construction as finally approved by the Harbor and Land Commissioners, the deposit cannot be withdrawn, and, whatever future action the company may take, its deposit must remain in the treasury.

It is apparent, therefore, that the question of the approval of the plans by the Harbor and Land Commissioners is one of vital

importance to the company. If, for example, the plans as finally adopted by that Board require a method of construction which, in the opinion of the company, is too expensive to be profitable, the opportunity is given it to abandon its project and receive its money back. It has a right, therefore, to know, before going further, just what is required of it in the way of location and construction.

Furthermore, the jurisdiction of the question of location and construction is confided to a Board which is presumed to be especially familiar with that subject, and which can adequately represent the interests of the Commonwealth and of the public. It is the duty, therefore, of the Harbor and Land Commissioners to settle all questions of construction, with one exception; that exception is the matter of the crossing of the canal by the railroad company. The jurisdiction of this question is given to a joint Board, consisting of the Railroad Commissioners on the one hand and the Harbor and Land Commissioners on the other; it being presumed that conflicting questions between the railroad and the canal are properly submitted to such a tribunal. Section 6, therefore, provides that such joint Board shall "determine at what point or points the railroad of the Old Colony Railroad Company shall cross said canal by a drawbridge or bridges, or by a tunnel or tunnels constructed under said canal." Such joint Board, after due notice, "shall determine said questions, and the decision of a majority of said joint Board shall be final. Said canal company shall construct its canal with such structures and appliances for its protection and use as said joint Board may order, together with such bridge or bridges, tunnel or tunnels, ferries and changes of highways, under the supervision of said joint Board, as shall be in accordance with plans approved by them."

All questions, therefore, which may arise concerning the manner of the crossing of the canal by the railroad company, and they only, are within the jurisdiction of the joint Board.

The determination of these questions may incidentally involve the further question whether, for the protection of the canal on the one hand or the railroad on the other, locks may be required; and it is in that aspect only that your Board has to determine any question concerning locks. Questions of navigation, or the velocity of the tide, and all other matters incidental to the question of the necessity of locks, are presumed to have been determined by the Board of Harbor and Land Commissioners before the plans come to your Board.

I do not forget that the words above quoted, "said canal company shall construct its canal with such structures and appliances

for its protection and use as said joint Board may order," taken alone, might seem to give original jurisdiction to your Board of the question of locks. But I cannot believe the Legislature intended a divided responsibility. As I have already said, each Board has its own duties in the matter. Your Board is concerned only with the crossing of the railroad; and the words "structures and appliances" must be taken, in connection with the rest of the section, to refer only to the matters to which the section as a whole relates. This is still more apparent from the fact that, after action by the Board of Harbor and Land Commissioners, the company, having elected to proceed, is not at liberty to withdraw and to receive back its deposit. It is not to be presumed that the Legislature, having once given an opportunity to the company to take back its deposit and withdraw from the enterprise, if the conditions as to construction imposed by the Board having jurisdiction of the matter are too onerous, should authorize another board to reimpose the same conditions, when the time for withdrawal has elapsed.

I am of the opinion, therefore, that the question of locks is not before your Board, excepting so far as the necessity of them may arise in consequence of the method of crossing by the railroad company determined upon by the Board may require structures for the protection of the canal and of the railroad company.

Very respectfully,

HOSEA M. KNOWLTON,

Attorney-General.

On April 15 the following letter was sent to the counsel for the canal company: —

BOSTON, April 12, 1901.

HON. WILLIAM M. BUTLER, *Counsel, Boston, Cape Cod & New York Canal Company.*

DEAR SIR:—The members of the joint Board of Railroad and Harbor and Land Commissioners met yesterday, to consider the opinion of the Attorney-General, defining the duties of the Board.

Following out this interpretation of the law, it seems clear that the joint Board has no jurisdiction until after an approval of plans for the construction of the canal by the Board of Harbor and Land Commissioners, and until application has been made by the canal company, under section 6, chapter 448, Acts of 1899. As soon as such application is made, the joint Board will, after due notice to the parties, proceed to determine the question of structures and appliances in accordance with the provisions of the above-named section. If the plans approved by the Board of Harbor and Land Commissioners shall provide for a canal without locks, the joint Board may be called upon to consider the subject of

locks as structures or appliances, within the meaning of this section of the statute.

We understand that the canal company has not as yet adopted on its plans the modifications suggested by the Board of Harbor and Land Commissioners, and that said plans have not been laid before that Board for final approval.

Very truly yours,

JAMES F. JACKSON,
Chairman.

On May 9 a petition of the company was filed with the joint Board for authority to issue capital stock to the amount of \$360,000, and bonds to a like amount, under authority of chapter 476 of the Acts of 1900. The following is a copy of the petition :—

COMMONWEALTH OF MASSACHUSETTS.

To the Board of Railroad Commissioners and Harbor and Land Commissioners, sitting as a Joint Board.

RESPECTFULLY REPRESENTS the Boston, Cape Cod & New York Canal Company, a corporation organized under chapter 448 of the Acts of 1899 and chapter 476 of the Acts of 1900, as follows :—

First.—This Board, sitting as a joint Board, by order dated June 26, 1899, authorized the issue of stock of your petitioner to the amount of one hundred forty thousand dollars (\$140,000), and bonds to a like amount, as soon as a deposit of two hundred thousand dollars (\$200,000) should be made by your petitioner with the Treasurer of the Commonwealth, in accordance with the provisions of section 23 of chapter 448 of the Acts of 1899; and the issue in like manner of such further amounts of stock and bonds, not to exceed in the aggregate (including the issues above mentioned) six million dollars (\$6,000,000) each, as from time to time on the application of your petitioner should have been approved and certified by said joint Board in the manner provided in chapter 462 of the Acts of 1894, as reasonably requisite to enable your petitioner promptly and in good faith to carry out the purposes set forth and specified in said chapter 448 of 1899; *provided*, that the total amount of bonds so approved, certified and issued should at no time exceed the total amount of capital stock then actually paid in and outstanding as aforesaid.

Second.—Prior to said order, and on the tenth day of June, 1899, your petitioner entered into a contract with the Cape Construction Company, a corporation duly organized under the laws of the State of New Jersey, by the terms whereof said Cape Construction Company agreed, among other things, to deposit for and on

account of your petitioner the sum of two hundred thousand dollars (\$200,000) with the Treasurer of the Commonwealth of Massachusetts, the sum of twenty-five thousand dollars (\$25,000) with the treasurer of the county of Barnstable, and the sum of five hundred dollars (\$500) each to the towns of Bourne and Sandwich, within the times required by, and in accordance with, the provisions of said chapter 448 of the Acts of 1899 for the making of such payments and deposits; and to proceed with all convenient speed to survey and lay out the location of the canal described in the charter of your petitioner, and file within four (4) months from the first day of June with the Harbor and Land Commissioners a plan of the proposed location and a plan of the proposed construction of said canal; and your petitioner agreed that on the deposit and payment of the several sums required by its charter to be paid and deposited in accordance with the provisions of said charter with the Treasurer of the Commonwealth, the treasurer of the county of Barnstable and to the towns of Sandwich and Bourne, being in all the sum of two hundred twenty-six thousand dollars (\$226,000), and upon the filing with the Board of Harbor and Land Commissioners of plans of the proposed location and construction of said canal, with the breakwaters, docks, wharves and other structures necessary for the convenient use of said canal in a form satisfactory to your petitioner, your petitioner would, as soon as might be thereafter, and upon request of said Cape Construction Company, forthwith pay and deliver or cause to be paid and delivered to said construction company shares of the capital stock and bonds of your petitioner of the par value of five hundred thousand dollars (\$500,000) of each such stock and bonds to be issued pursuant to its charter.

Third. — Under the aforesaid order there have been certified and issued to your petitioner stock to the amount of one hundred forty thousand dollars (\$140,000), and bonds to a like amount.

Fourth. — Said Cape Construction Company has made all deposits and payments and performed all acts necessary under its contract with your petitioner above mentioned to entitle it to the payment and delivery to it by your petitioner of shares of the capital stock and bonds of your petitioner to the par value of five hundred thousand dollars (\$500,000) of each such stock and bonds to be issued pursuant to its charter, except the deposit of twenty-five thousand dollars (\$25,000) with the treasurer of Barnstable County, and that it stands ready to deposit said amount; and upon such deposit your petitioner will be liable to said Cape Construction Company for the payment and delivery of said stock and bonds, but is unable to meet said obligation until the certificate

and issue to it of stock to the amount of three hundred sixty thousand dollars (\$360,000), and bonds to a like amount, shall be approved and certified by this Board, sitting as a joint Board; and that, in order to enable your petitioner to comply with the other terms of said contract to be subsequently performed, it will be necessary that the further amounts of said stock and bonds mentioned in said contract be issued and certified as provided by said contract.

WHEREFORE, your petitioner prays that this joint Board will approve and certify to the Old Colony Trust Company as reasonably requisite to enable your petitioner to promptly and in good faith carry out the purposes set forth and specified in said chapter 448 of the Acts of 1899, the immediate issue and certification of capital stock of your petitioner to the amount of three hundred sixty thousand dollars (\$360,000), and of bonds to a like amount and the further issue and certification of stock and bonds to the amounts set forth in said contract, from time to time, on certificate of this Board that the work required under said contract for the delivery of such stock and bonds has been completed.

BOSTON, CAPE COD & NEW YORK CANAL COMPANY,

By CHARLES C. DODGE,

President.

On May 23 the joint Board met, and heard parties interested on the foregoing petition, and took the matter under advisement.

On July 1 the joint Board met, and signed the following order, refusing to approve an issue of stock and bonds by the canal company, as petitioned for May 9, 1901:—

PETITION OF THE BOSTON, CAPE COD & NEW YORK CANAL COMPANY FOR APPROVAL OF AN ISSUE OF STOCK AND BONDS.

After due notice to all parties interested, a public hearing was given upon this petition.

The petitioner in the early part of 1899 applied to this Board, under the provisions of chapter 448 of the Acts of 1899, for authority to issue capital stock to the amount of \$6,000,000, and bonds to the amount of \$6,000,000.

After a careful consideration of the evidence and arguments presented in support of the petition, the Board issued an order, under date of June 26, 1899, authorizing the issue of this amount of stock and bonds, in such amounts as the Board from time to time, upon evidence presented to it, should deem requisite for carrying out the lawful purposes of the company.

The order authorized an immediate issue of stock to the amount of \$140,000, and of bonds to a like amount, to provide the means for payment of certain deposits which the statute required the company to make, and for payment of expenses connected with the making of surveys and plans. The approval of the issue was made dependent upon the performance of certain conditions named in the order.

Upon the request of the petitioner for a modification of this order, the case was re-argued in the following September, and modification refused.

Since then additional legislation has been secured by the petitioner, to be found in chapter 476 of the Acts of 1900. That statute authorizes the joint Board to approve a contract or contracts for the building of the canal, by the terms of which stock and bonds may be issued in payment for labor and material; but provides that such contract or contracts shall first be open to bids, and that there shall be public advertisement for such bids. It is suggested by counsel for the petitioner that the Board has power to waive the giving of the public notice named in this statute. We cannot agree that we have this power, nor that, if we had it, we ought to exercise it. The opportunity through advertisement for bids to secure the benefits of competition are clearly an essential feature of the legislation of 1900.

The petition now before us is based, then, upon the same provisions of law that governed the action of the Board upon the former petition. Indeed, the petitioner practically admits this, but claims that conditions have materially changed. It is true that some additional steps have been taken, looking to the carrying out of the enterprise. Large expenditures have been made upon plans for the construction of the canal, and in the presentation of them to the Board of Harbor and Land Commissioners. That Board, after several hearings and a careful, expert investigation, has suggested certain modifications in the plans, and has signified that upon the adoption of such modifications the plans will be approved. There still remain, however, questions of great importance connected with the construction of works necessary to the completion of the canal. No steps have as yet been taken to bring these questions before the joint Board which is to decide them. Moreover, although full authority was given to the petitioner, under the order of 1899, to issue stock and bonds for certain specific purposes, no such issue has been made, and the requirements of the order in respect to the preliminary steps to be taken by the company have not been carried out.

At this point we are asked to approve an issue of stock and

bonds upon the basis of a contract between the Boston, Cape Cod & New York Canal Company, the petitioner, and what is known as the Cape Construction Company, executed June 10, 1899, which provides for the payment to the Construction Company of \$12,000,000 in stocks and bonds as the cost of building the canal. An approval of this petition, although it calls for the issue at present of stocks and bonds amounting to \$1,000,000 only, would be to all intents and purposes an approval of that contract; would mean that, without any presentation of evidence of the actual or estimated cost of the completed canal, the joint Board would be irrevocably committed to the possible over-capitalization of a public enterprise. All the arguments in favor of such action were exhaustively presented to this Board in connection with the petition of 1899. The circumstances under which these arguments are again urged upon our attention are substantially unchanged, and the joint Board sees no reason to depart from its former adjudication.

Whenever the company shall offer satisfactory evidence to prove that an issue of capital stock and bonds is reasonably requisite to carry out any one of the purposes recognized by the statute, the approval of this Board will be given to such issue upon conditions similar to those named in its former order.

We cannot, upon the evidence presented in support of this petition, approve the proposed issue of stock and bonds.

JAMES F. JACKSON,
 GEORGE W. BISHOP,
 CLINTON WHITE,
Railroad Commissioners.
 WOODWARD EMERY,
 CHAS. C. DOTEN,
 GEO. E. SMITH,

Harbor and Land Commissioners.

Boston, July 1, 1901.

APPONAGANSETT HARBOR.

By chapter 38 of the Resolves of 1901, the Board was directed to cause a survey and estimate to be made as to the advisability and cost of improving the harbor at Apponagansett in the town of Dartmouth, by constructing a break-water at its entrance or by some other means, and to report thereon to the General Court.

The necessary survey and estimate has been made, and the report of its engineer duly considered by the Board.

The construction of a stone breakwater at the entrance to Apponagansett harbor is entirely feasible, and is unquestionably the best means of affording the desired protection. The large cost of the project would raise a question as to its advisability. A plan of the project is appended. The report of the engineer in full is as follows : —

BOSTON, Dec. 18, 1901.

To the Board of Harbor and Land Commissioners, State House, Boston.

GENTLEMEN : — In accordance with your instructions, I have had a survey and estimate made to determine the cost of improving the harbor at Apponagansett in the town of Dartmouth by constructing a breakwater at its entrance and removing some of the bowlders which obstruct the anchorage ground, pursuant to the provisions of chapter 38 of the Resolves of 1901.

The harbor is formed by a bay at the mouth of Apponagansett River in South Dartmouth, on the western shore of Buzzards Bay, about 2 miles south of New Bedford. The bay is about 3,000 feet wide at its mouth opposite Ricketson's Point, and narrows to about 1,500 feet at the bridge, 4,000 feet above, which is practically the limit of navigation. The anchorage in the bay is well protected from winds coming from all directions except the south-east, and gales from this direction often come up suddenly and are quite violent, having a rake of the whole width of Buzzards Bay for about 11 miles.

The survey covers the whole area of the bay, the topography being carried for about 1,000 feet northerly along the Buzzards Bay shore and down to the Nonquit wharf on the southerly shore of the bay. The soundings cover the whole area from the bridge down to the mouth of the bay, and extend out into the sound a sufficient distance to cover all possible locations of a proposed breakwater. The bottom of the bay is quite hard, as shown by the many rocks projecting above its surface. Ricketson's Point consists of ledge, the outer slopes of which are covered with many bowlders.

At the anchorage inside Ricketson's Point and within the line of the proposed breakwater there is a depth of not less than 12 feet of water over an area of 101 acres, and a very large part of this is over 16 feet in depth ; and, if it is protected from southeasterly gales, it will afford a remarkably convenient and safe anchorage. At the present time it is much frequented by yachts from New Bedford, yacht owners preferring to keep their yachts here rather than in New Bedford harbor, where the water has become so foul as to interfere very much with keeping the yachts

clean. During the last year the New Bedford Yacht Club has erected a club house near the bridge at the head of this harbor; and, as there is an electric car line which makes frequent trips between South Dartmouth and New Bedford, it is very convenient for yachtsmen, as a yacht can get into the open bay much quicker from this point than from New Bedford harbor in the south-westerly winds which prevail in summer.

The only question seems to be as to the best location for the breakwater; and, having due regard for the cost of the work and the anchorage area to be secured, I have finally located it running in a south-westerly direction from the extreme end of Ricketson's Point, leaving the opening between the south-westerly end of the breakwater and the 12-foot curve on the Nonquit shore about 800 feet. This will protect, as before stated, an area of 101 acres, having a depth of more than 12 feet at mean low water; and, if a larger area is required in the future, it would probably be cheaper to dredge the flats at that time than to locate the breakwater farther out to sea at the present time.

During the survey our attention was called to a number of bowlders scattered in various parts of the harbor, and an effort was made to find and determine their location. A number of these bowlders were found and their position marked on the chart; but the engineers were told that there were a number of others, but they were unable to find any one who had time to go out and point out their location, and, although search was made, they were unable to find them themselves.

The cheapest effective form of breakwater which can be built in this location is one composed of granite quarry grout, having side slopes flat enough to stand the effects of the sea, the blocks on the exposed faces being large enough not to be individually rolled about by the sea to which they are exposed. I have planned this breakwater to be 10 feet wide on top, at an elevation 10 feet above mean low water; the outer face to slope at an angle of $1\frac{1}{2}$ to 1 from the top to the bottom; the back side toward the harbor to be vertical for a distance 5 feet from the top, and then slope at an angle of $1\frac{1}{2}$ to 1 to the bottom; the head at the outer end of the breakwater to be 20 feet in diameter, 10 feet above low water, with side slopes of 2 to 1 all around. This will require about 121,200 tons of stone. The estimated cost of the work is as follows:—

121,200 tons of stone, at \$1.20,	\$145,440
Removing bowlders from the harbor,	500
Engineering and contingencies,	14,500
Total,	<u>\$160,440</u>

The above estimates are for a breakwater to cover the largest possible area of anchorage ground ; but if a breakwater should be built only one-half as long, the safe anchorage for small boats and yachts would be very largely increased over what it is at the present time ; and if it is desired at any time to complete the work, in order to secure the greatest possible advantage from the breakwater, there will be no loss from taking down the work already constructed, — it will simply have to be added to.

Respectfully,

FRANK W. HODGDON,
Engineer.

HERRING RIVER.

By chapter 66 of the Resolves of 1901, the Board was directed to cause a survey and estimate to be made as to the advisability and cost of improving the entrance to Herring River in the town of Harwich, and of erecting barriers for the protection of the beach in that vicinity, in order to provide a harbor of refuge for small sailing craft and to protect the shore line, and to report thereon to the next General Court.

The necessary survey and estimates have been made, and the report of its engineer duly considered by the Board.

In order to maintain an effectual opening at the mouth of the river, it would be necessary to build two jetties, of which the western should be the longer. These may be of timber or of stone, but inasmuch as, if built of timber, they would within a few years require to be reinforced by stone, that is the material the Board would recommend to be used in construction. The jetties for the purpose of navigation alone might be built at substantially right angles to the shore ; but the drift of seaweed on this shore cannot be ignored, especially in designing a structure intended for increased comfort and accommodation to the public ; therefore the plan providing for a channel at an angle of about 45° to the shore, which is the more favorable to allowing seaweed to drift across the mouth of the opening, is to be preferred, should the Legislature see fit to make the necessary appropriation. The estimate of cost seems large in comparison with the number of possible beneficiaries of the improvement. If built at the angle proposed, there is no certainty that seaweed will not accumulate and create a nuisance, as at Witchmere. For

these two reasons the Board is unable to say affirmatively that it is advisable to make the improvement suggested.

A plan of the project is appended. The report of the engineer in full is as follows :—

BOSTON, Dec. 10, 1901.

To the Board of Harbor and Land Commissioners, State House, Boston.

GENTLEMEN:—In accordance with your instructions, I have made surveys and estimates to determine the advisability and cost of improving the entrance to Herring River in the town of Harwich, as authorized by chapter 66 of the Resolves of 1901. The surveys were made in the month of June, and extended for about a mile along the shore of Nantucket Sound at the mouth of the river and for about one mile up the river. The topography was mapped and soundings taken out to a depth of about 10 feet at mean low water. The river is generally about 100 feet wide between the marshes, but widening in places to 200 feet or over. The thread of the channel has a depth, where it passes through the crest of the beach, of from 3 to 4 feet at mean low water, but above this and on the outer slope of the beach it is not over 1 to 1½ feet.

The action of the sea and the current has deposited large quantities of sand in the sound opposite the mouth of the river, so that the line 3 feet below mean low water opposite the mouth is about 1,500 feet from the shore line, while half a mile on either side it is not over one-half that distance.

At the present time there is a timber fence or jetty, built of stakes and planks, on the westerly side of the outlet, which has been built by the town, with the aid of contributions from people living in the vicinity. This structure was built of such light materials that the sea has damaged it so that it has required constant repairs; and, while it has protected the entrance to a certain extent, it has not been sufficient to maintain a safe entrance into the mouth of the river.

There are two bridges crossing the river near its mouth, one about a quarter of a mile from the mouth, which is about 45 feet long and built on piles, the approach on either side being a solid causeway. The opening is so narrow that the current has scoured a deep hole near the bridge. The second bridge is located about one mile from the mouth, and is an iron truss bridge with a span of about 120 feet, the full width of the river between the marshes. Just above this bridge, previous to 1870, a dam was built to reclaim the salt meadows above and turn them into hay land, the same as was done at Green Harbor. This dam remained

for a number of years, but some time before 1880 it broke away and was wholly removed. During the time it was in existence the tidal volume of the river was very largely reduced, and, as at Green Harbor, considerable quantities of sand were driven by the sea and the tide into the lower reaches of the river.

The river drains a large territory, extending well up into Brewster, and is the outlet of a number of large ponds in that vicinity; but the fresh water flow is small compared with the tidal flow.

The general drift of the sand along the shore in this vicinity is from west to east, and the jetty already built on the westerly side of the outlet has checked this drift and built out the shore line for about 200 feet beyond the general line of the shore. This protects the beach on the easterly side of the outlet from waves coming from the south-west, but leaves it exposed to those from the south-east, which now cut away the bluffs to the east of the outlet, there being no jetty at present on the easterly side to protect the entrance. This drifting sand, being forced over into the channel faster than it could be cut away by the current, has gradually forced the channel well over to the eastward, so that it now has cut away the sand from back of the jetty, and is flowing out across the line of the inner end of the jetty. The sand thus scoured out is deposited in the sound in front of the outlet.

New works to improve the entrance should consist of a jetty on each side of the mouth of the river, one of which, at least, should extend out to a depth of 3 feet or more at mean low water. If the question were simply to make a safe entrance for boats into the mouth of the river, protected from sand drifted by the waves and current, jetties built out at right angles with the general trend of the shore would probably work best; but in this locality large quantities of seaweed are annually torn up from the bottom of the sound and thrown up on the beach during the summer months. The prevailing summer winds being from the south-west, this is driven along the beach, and would be lodged against the westerly jetty, and become a great nuisance to users of the beach for bathing and similar purposes. This seaweed can be removed only by being taken from the water and carted away, as, if it is allowed to remain, the odors coming from it are very offensive. In order to avoid this trouble, I have designed jetties extending south-easterly, making an angle of about 45° with the general trend of the shore, with the expectation that, as the seaweed is driven by the waves along the shore, it will slide along the back side of the jetty and be carried across the line of the channel and landed on the beach to the eastward, the jetties being planned so that south-westerly waves will strike not exactly at a right angle, but at such an angle

as will drive the seaweed along the jetty until it reaches its outer end. One objection to this location of the jetties is that there is some possibility that the sand may be driven by the outer end of the jetty, as it is driven along the shore by the same forces which move the seaweed; but, as the sand is moved by rolling along the beach, and does not float on the surface, as does the seaweed, I do not think that any serious trouble will occur from this cause.

If the jetties are thus located, it will be necessary to deflect the ebb current in the river practically at right angles to the course at which it approaches the beach, and the bank at this place will have to be thoroughly protected to keep it from wearing away.

The easterly jetty is planned much shorter than the westerly one, in order that the seaweed will not be caught in the flood current before it has had an opportunity to pass by the entrance. As the location of the jetties is principally on the flats, whose surface is less than 1 foot below mean low water, estimates have been made for timber jetties as well as for more permanent stone ones; the timber work to be substantially the same as that built at Osterville and Witchmere harbor, and, as at Osterville, they will have to be strengthened with stone at some future time. The width between the jetties has been fixed at 150 feet.

Owing to the limited volume of tidal water, it will be necessary to dredge the entrance channel, as the current will not be strong enough to scour it unaided, relying on the current to maintain it after it is excavated. After a study of the present channels, I have decided to recommend that the dimensions of the proposed entrance channel be as follows: 100 feet wide on the bottom, with the necessary side slopes, and 3 feet deep at mean low water. This gives a section considerably larger than that of the channel which the current now maintains through the beach; but this has to maintain itself by scouring out the sand which is constantly being driven in by the waves, while the new channel will be protected by jetties. In order to get the full benefit of the tidal flow to maintain the channel, the opening in the lower bridge across the river should be made at least double its present width.

On the westerly bank of the river at its mouth is located a large summer hotel and a considerable village of summer cottages, and on the opposite bank there are also a number of summer cottages.

I submit herewith estimates for two methods of improving the entrance: one by a channel to be located substantially at right angles with the shore of the sound, the other with the entrance channel trending to the south-east, planned to avoid the nuisance caused by the drifting seaweed. In each I have estimated the cost of the jetties built both of wood and of stone.

The cost of the first plan may be reduced by omitting 200 feet

from the outer end of the easterly jetty; and I would suggest, if this plan is adopted, that this section be omitted, as I have seen channels maintain themselves in very good condition where they were protected by jetties one of which projected a considerable distance beyond the other. If at any time in the future it is found advisable to improve the channel still further, this jetty can be extended to its full length without interfering with any portion of the work previously constructed. The estimates are as follows: —

Channel at right angles to the shore, with timber jetties: —

Dredging,	. . . . .	\$9,600
Jetties,	. . . . .	22,500
Supervision and contingencies,	. . . . .	3,200
		<hr/>
		\$35,300

Channel at right angles to shore, with stone jetties: —

Dredging,	. . . . .	\$9,600
Jetties,	. . . . .	44,200
Supervision and contingencies,	. . . . .	5,300
		<hr/>
		\$59,100

As before stated, this estimate may be reduced by shortening the eastern jetty 200 feet, as follows: —

For the wooden jetties,	. . . . .	\$2,700
For the stone jetties,	. . . . .	8,100

Channel at an angle of about 45° to the shore, with timber jetties: —

Dredging,	. . . . .	\$7,600
Jetties,	. . . . .	22,600
Supervision and contingencies,	. . . . .	3,000
		<hr/>
		\$33,200

Channel at an angle of about 45° to the shore, with stone jetties: —

Dredging,	. . . . .	\$7,600
Jetties,	. . . . .	41,600
Supervision and contingencies,	. . . . .	4,900
		<hr/>
		\$54,100

The general location of the proposed jetties is shown on the annexed plan.

Respectfully,

FRANK W. HODGDON,

Engineer.

EAST BAY.

Chapter 102 of the Resolves of 1901 reads: "That the board of harbor and land commissioners may, if in their opinion the change of conditions since the surveys and estimates authorized by chapter ninety-six of the resolves of the year eighteen hundred and ninety-nine so warrant, make such further surveys and estimates as they may deem necessary as to the advisability and cost of cutting a channel from East bay, in the town of Barnstable, to Vineyard sound, for the purpose of providing a harbor of refuge; and they shall report thereon to the next general court not later than the first day of February." Upon due consideration, the Board was not of opinion that there was any change of condition sufficient to warrant making further surveys and estimates as to the advisability and cost of cutting the proposed channel.

The estimate of the cost of the channels and protective works, as stated in the annual report of the Board for the year 1899, pages 40-43, cannot be substantially changed without diminishing the extent and character of the protective works provided in that estimate; and the Board has not been able to find any such change in conditions or in the reasons which controlled their previous opinion as to feel justified in recommending any change in the need or extent of the protective works and dredging therein suggested as necessary to properly construct and maintain the desired channel.

BASS RIVER.

By chapter 39 of the Resolves of 1901, the Board was directed to cause a survey and estimate to be made as to the advisability and cost of improving the entrance to Bass River in the towns of Dennis and Yarmouth, and to report on the same as soon as the survey and estimate were completed. This was done, and the report (House, No. 1430) made June 4, 1901, making an estimate of \$22,000 as the cost of the suggested improvements. By chapter 113 of the Resolves of the same year the Board was directed to improve the channel in accordance with the report, and an appropriation of \$22,000 was made for the purpose.

Plans and specifications were prepared for the construction

of two timber jetties, one on either side of the river mouth, and for the excavation of a channel between them, across the flats, to the depth of 4 feet at mean low water.

On November 14, after opening proposals as advertised, a contract for labor and material was made with Augustus Bellevue & Co., the lowest bidder. Work will commence early in the spring.

SCITUATE.

In pursuance of chapter 434 of the Acts of 1900, the Board made an examination of the shores and harbor of the town of Scituate, and concluded that it would be necessary to build a sea wall at the Sand Hills, so called, where the ocean broke across into the harbor in the great storm of November, 1898. Accordingly a contract was made with Taylor, Carr & Andrews, and in accordance therewith a concrete sea wall 998 feet long, with a uniform surface level and about 8 feet above the plane of mean high water, was built at a cost of \$5,408.05. The sand comes up to the level of the top of the wall on the inside.

The work was completed in the middle of December, 1900, and has withstood the heavy storms and high tides in the most satisfactory manner. It promises to afford complete protection to the harbor against any easterly or north-easterly gales.

At the request of the selectmen, the Board visited Stage House beach and the beach at the north end between Damon's Island and the Glades. The sea is undoubtedly wearing away the Third Cliff; but the protective work that would prevent the shores of the cliffs from washing would be attended with large expense, and not worthy the undertaking unless the coast for a long distance should be included. At the north end of the beach, however, after a careful examination and watching the effect of some recent storms, notably the one of Nov. 25, 1901, the Board has concluded it would be wise to expend the balance of the appropriation in building a protective wall somewhat similar to the one built to protect the harbor.

While the Board does not concur in the fear expressed by residents of Scituate that there is a liability of inundation across this beach and the marshes behind it into Cohasset

harbor, it nevertheless is of opinion that building the proposed wall would prevent the rolling back of the beach.

The apprehensions of the town were expressed to the Board through a committee, who stated that so great was their feeling about the necessity of this protective work, the cost of which would exceed the balance of the appropriation, that the town would appropriate a sufficient sum, in addition to the available balance of the appropriation, to have it carried out in such form as the Board would require it to be done. This work will presumably be commenced in the early spring.

GREEN HARBOR.

Early in the summer a survey was made of the channel at Green Harbor which was excavated the previous year. As dredged, the channel was 60 feet wide on the bottom and 5 feet deep at low water. Near the outer ends of the jetties the banks had washed down, and thus had widened, although shoaled, the channel in that location; the inner portion of the channel was found to have suffered but little change.

The anchorage basin which was excavated above the Narrows had shoaled considerably at its inner end, where the current on the ebb tide washed down quantities of sand from farther up the harbor. These changes were not unexpected, but their extent could not be anticipated.

The improvements made have renewed the interest of the fishermen, yachtsmen and others, and during the season the fishermen put a number of naphtha launches into use. The channel, even with the shoaling which has taken place at the entrance, has substantially as much water as there was on the bar previous to the construction of the dike, and is giving great satisfaction.

The extreme high tide of Nov. 18, 1901, damaged a portion of the bulkhead, built at the inner end of the western jetty to prevent the sand from blowing and drifting into the harbor. This damage has been repaired at a small expense, in a manner which will prevent a recurrence of the trouble.

The total expenditure on the harbor since the passage of chapter 469 of the Acts of 1898, authorizing its improvement, is \$65,790.47. On account of the settlement of a portion of the stone jetties, additional stone will be required to restore their original elevation.

OSTERVILLE.

In May an examination and survey was made of the channel at West Bay, Osterville, to determine what changes, if any, had taken place there. It was found that the depth of water at the entrance channel between the jetties and on the shoal at the end of the jetties had increased; and that the channel across the bay, while maintaining its depth of nearly 3 feet at mean low water throughout its length, had altered its bed somewhat, but was generally in good condition.

This harbor has been considerably used by pleasure boats during the past season. The worms have eaten the planks in some sections of the jetty to a considerable extent, and a few of them have been wholly eaten off. It was therefore determined to continue the work of strengthening the jetties by means of stone riprap, as had already been commenced, and a contract was made Sept. 17, 1901, with Eugene S. Belden of Hartford, Conn., to place 1,200 tons of stone in the jetties, at the price of \$2.47 per ton. The whole length of the timber work is now protected by stone riprap, and it is not anticipated that any further expenditure will be required on these structures for a number of years.

The cost of the work done this year is as follows:—

Stone riprap,	\$2,964 00
Surveys and supervision,	17 50
	<hr/>
	\$2,981 50

The total cost of the work is \$20,865.39.

LAKE ANTHONY.

By chapter 399 of the Acts of 1901, the Board was authorized to expend a sum not exceeding \$5,000 for dredging and other necessary work to improve the harbor at Lake Anthony, Cottage City.

In May a survey was made to determine the depth of water and character of the bottom in the harbor and its entrance. The stone jetties and entrance channel were found in good condition; a slight shoaling was found in the entrance channel about opposite the low-water mark on the beach outside of the jetties, but not, however, sufficient to reduce the navigable depth of the channel. The bottom

of the harbor proper was found to consist of a considerable depth of soft mud, which supported a luxuriant growth of grass. It was learned that in the previous season vessels anchoring there had dragged anchors during severe squalls until they grounded.

An estimate was made of the cost of excavating this mud, in order to get good holding ground; but the quantity was so large that it could not be done with the available appropriation. It was also found that the approach to the landing wharf which had been built on the Cottage City side of the harbor was too shoal for use by the larger class of boats, and it was therefore decided, after conference with the local authorities, to confine the dredging to the excavations required to give boats free access to this wharf at all times, and to place ten heavy moorings in the harbor, to which yachts and vessels could be moored securely. The necessary stones, chains and buoys were purchased, and a contract made with George H. Cavanagh, whose plant was in that vicinity, to set the moorings and do all needful dredging for the sum of \$2,500, also to remove any shoaling which had taken place in the entrance channel. The moorings were set early in the season, and the work completed in a satisfactory manner by Oct. 21, 1901. The material excavated was deposited on the adjacent shore, where, after being levelled down, it will form a smooth, steep beach, and greatly improve the shores of the lake.

At the suggestion of this Board a harbor master was appointed, who will take charge of and regulate the use of the moorings.

The cost of the work done this year is as follows:—

For moorings,	\$296 68
For setting moorings and dredging,	2,500 00
Surveys and supervision,	66 88
Total,	<hr/> \$2,863 51

The total cost of the work is \$24,290.64.

The United States lighthouse department has placed two lights at the ends of the jetties which were built by the Commonwealth, within an area 10 feet in diameter in the centre of the head of each jetty, which by request was con-

vayed to the United States under the provisions of section 7 of chapter 1 of the Public Statutes for the purpose of erecting and maintaining these lights. The structures were erected and the lights put in operation in August. The conveyance was made after consultation with the Attorney-General, who confirmed the authority of the Board to take action in a communication, of which the following is a copy:—

BOSTON, June 25, 1901.

HON. WOODWARD EMERY, *Chairman, Board of Harbor and Land Commissioners.*

DEAR SIR:—Your letter of June 4 states that “under the provisions of Statutes of 1898, chapter 441, and Statutes of 1899, chapter 155, the Board of Harbor and Land Commissioners has cut a channel between Lake Anthony at Cottage City and Vineyard Sound, about 5 feet deep and 100 feet wide on the bottom, and has protected the same by building two stone jetties on either side of the cut, extending into the sound about 200 feet beyond the low-water mark, reaching a depth of about 8 feet at mean low water. . . . The United States Lighthouse Board is willing to maintain lights on the end of the jetties. The ends of the jetties are built up (as are the entire jetties) by loose stones piled up, between the interstices of which the water readily flows.”

The question submitted by your letter is, whether the Board may convey the land upon which the ends of the jetties have been erected to the United States for the purpose of maintaining lights and lighthouses thereon, it being one of the provisions of the U. S. Revised Statutes that no lighthouse shall be erected on any site until “cession of jurisdiction over the same has been made to the United States.”

The authority of your Board is to be found in Public Statutes, chapter 1, section 7, which provides: “The board of harbor and land commissioners, with the approval of the governor and council, may in the name and behalf of the Commonwealth convey to the United States the title of the Commonwealth to any tracts of land covered by navigable waters, and necessary for the purpose of erecting lighthouses, beacon lights, range lights, or other aids to navigation, or lightkeepers’ dwellings, upon the application of any authorized agent or agents of the United States: *provided*, that such title shall revert to and revest in the Commonwealth whenever such land ceases to be used for such purposes.” There can be no doubt that the circumstances of the case bring it within the provisions of this statute.

The jetties extend out 200 feet below low-water mark, and reach to a depth of 8 feet at mean low water. They are built of loose stones, through the interstices of which the water readily flows. The soil upon which the jetties rest is, therefore, the property of the Commonwealth, and title to it may be conveyed by your Board to the United States, under the statute quoted and subject to the conditions named therein.

Very truly yours,

H. M. KNOWLTON,
Attorney-General.

MENAMSHA INLET.

In July an examination was made of the structures which have been built since 1897 at the mouth of Menamsha Inlet in Chilmark. The works generally were found in good condition, the entrance channel being larger than at any time since the construction of the jetties. The timber structure which had been built to the westward of the westerly jetty had caused the beach to build up, and prevented the sand from being driven into the channel so far as it extended; but beyond it, as the beach was built up, sand was driven through spaces between the stones of the jetty. These holes can be closed at slight expense.

On the easterly side the current has cut away the sand from behind the wing of the jetty which extended along the beach, and the river channel thus widened has shoaled to some extent.

Before doing anything, it was decided to make a survey, to determine the exact status of the situation, and this was done in September. The cutting in rear of the easterly wing jetty was increasing, therefore it was deemed advisable to make plans and estimates for straightening the channel of the creek, as was originally contemplated. The estimates, however, of the cost of doing all that would be necessary if once started, were so large as to preclude action by the Board without special authority. Since then in a heavy north-easterly storm a section of the wing jetty has been overthrown, and a large quantity of sand and gravel deposited in the channel. No danger that the water of the creek will break through and make another opening, however, need be apprehended.

The jetties at the entrance of this harbor were originally

located at equal distances on either side of the boundary line between the towns of Chilmark and Gay Head, in substantially the middle of the outlet of the creek across the bar, at a point about 450 feet westerly from the bend where the main channel of the creek approached and ran along inside the beach; thus the creek, in flowing toward the beach along inside it and thence out through the jetties into the sound, turned at practically two right angles in its course.

In case it shall be thought best to carry out the project as originally planned, and secure the best results from the construction of the jetties, it will be necessary to excavate a channel across the flats from the entrance between the jetties toward the inner end of the bluff near the Tilton house, and to build two short jetties or training walls at either end of the excavated channel, to direct the current into it. To do this would tend to permanently deepen the entrance and enlarge the present harbor. The cost would probably not exceed the sum of \$5,000.

The total amount expended is \$9,952.20.

WITCHMERE HARBOR.

During a heavy south-west gale in the spring of 1901 a few of the stones in the western jetty, built by the Commonwealth in 1899 and 1900, were washed off and dropped into the channel. At the same time considerable quantities of sand were washed from the beach over the top of the jetty into the channel. In September these stones were replaced in the jetty, and a timber bulkhead built on the crest of the beach to prevent the sand from driving over the top of the jetty. The total expense of this work was as follows:—

Repairs and materials,	\$99 04
Surveys and supervision,	26 80
	<hr/>
Total,	\$125 84

While this work was in progress a survey was made of the channel, which was found to have been scoured by the current, as was expected, and to a greater depth throughout its length than in the previous year.

The people living in the vicinity are much disturbed by the quantities of seaweed driven onto the beach and held there by the jetties. This is a serious interference with the use of the beach for bathing and its enjoyment by the summer visitors; but if the jetties were removed and the seaweed allowed to drift along the beach, large quantities would drive into the harbor and land just at the inner end of the entrance channel, as it did before the construction of the jetties. The decay of the seaweed lodging on the beach gives forth offensive odors. There seems, however, to be no remedy for the nuisance created by this collection of seaweed except by removing it.

This is a duty which the Board, when applied to by the selectmen, decided was beyond its scope, but suggested that possibly the stuff had a commercial value if removed from the water and dried, in which case the cost of doing the work might be repaid by the sale of the material, thus keeping the beach clean, and giving employment to a number of the inhabitants.

The total amount expended is \$4,824.17.

SCORTON HARBOR.

An inspection and examination of the mouth of Scorton harbor was made in November last. The mouth, as was not unexpected, has been shoaled and diverted along the coast to the south-east, owing to the movement of material along that unprotected shore. It affords an instance of the necessity of protecting by jetties the mouth of rivers which debouch through a sandbar or spit. The action of the waves in stormy weather, stirring up the sand, and of the currents in moving the particles along and finally depositing them where there is less motion of the water, renders it futile to dredge an entrance in an exposed situation without thoroughly protecting it, as has been done by this Board at other outlets. The appropriation in this instance made no provision for jetty work.

The total amount expended is \$2,948.47.

PLYMOUTH HARBOR.

In March the Boston, Plymouth & Provincetown Steamboat Company made request that a shoal in the channel of Plymouth harbor near the wharf on Long beach be removed. On March 25 to 28 a survey was made, and it was found that the point of a flat in this portion of the channel projected so far as to make passage difficult, and plans were made for dredging a sufficient quantity of material to enable vessels to round it in safety.

On April 20 a contract was made with the Harries & Letteney Company, the lowest bidder, to do the work, for 28 1-2 cents per cubic yard, and it was completed May 10, 1901.

The total cost of this work is as follows:—

Dredging,	\$797 72
Surveys and supervision,	76 56
Total,	<u>\$874 28</u>

The United States government in November of this year completed a dike of heavy riprap on Long beach, 10,468 feet in length, about 18 feet in height above mean low water, and containing 28,600 tons of stone. This work is of very substantial character, completely protecting the harbor, and was rendered necessary by the total destruction of all the government works along that part of the beach in the great storm of Nov. 27, 1898.

A test of the character of this new work was afforded in the severe storm of November 25 of the present year, when the gale, tide and surf approached at their maximum the conditions of 1898; yet the riprap withstood the heavy pounding of the sea without receiving damage at any point.

PROVINCETOWN HARBOR.

Although the importance of this harbor is such as to bring it within the care and supervision of the federal authorities, nevertheless, the Board exercises a watchful interest over its condition.

In April authority was granted the Boston, Plymouth & Provincetown Steamboat Company to dredge in Province-

town harbor for the improvement of the channel leading up to its wharf.

Early notice was received by the Board from its agent at Provincetown that the governmental protective works designed to prevent the influx of the ocean to the upper reaches of the harbor had been seriously impaired by the storm of November 25 last. The information was immediately transmitted to the federal authorities having charge of the works; as should, by any chance, the ocean make a breach through the thin neck of sand at the upper end of the harbor, the consequences, though unforeseeable, could not but be injurious, if not destructive, to the harbor.

NEW BEDFORD HARBOR LINES.

In pursuance of an order of the Legislature of Feb. 4, 1901, requiring the Board to investigate the advisability of changing the harbor lines on the westerly side of Fish Island in the harbor of New Bedford, a hearing was duly advertised and held at the city hall in New Bedford on February 19.

After a full hearing, at which an opportunity was given to every one desiring to be heard, the Board reported a bill changing the harbor line, which was subsequently enacted as chapter 243 of the Acts of 1901.

The change in the line will unquestionably be beneficial to shipping obliged to pass through the new draw between Fish Island and Pope's Island for the purpose of discharging at the wharves opposite Fish Island just above the old bridge.

GREAT PONDS.

The growing public taste for summer outing places has led to the occupation of the shores of great ponds and the islands to a degree never before experienced.

The title to and ownership of islands in great ponds often present questions of novelty and importance.

Application is not infrequently made to the Board for leases of such islands; and now and then the attention of the Board is directed to the occupancy of an island to which it is claimed the occupant has no title, but is squatting on the lands of the Commonwealth.

With reference to leasing the islands, the Board is inclined

to view them as affording increased opportunity for public enjoyment of the rights secured by the Colony Ordinance of 1647 in the great ponds themselves, and not, therefore, as possessions to be appropriated to the exclusive and particular use and enjoyment of private individuals, and has consequently declined hitherto to grant leasehold interests to those petitioning for them.

Before taking action with reference to such islands as may appear to belong to the Commonwealth, but as to which the title is doubtful, the Board took the opinion of the Attorney-General, whose letter, addressed to the chairman, reads as follows:—

DEAR SIR:— Your letter of October 8 states that the Board of Harbor and Land Commissioners desires to be informed “whether or not islands in great ponds to which no private individual has title are property of the Commonwealth, with reference to the possession of which this Board has a duty to perform.”

The term “great pond” has been used in the statutes of the Commonwealth from time immemorial. It originally signified an inland body of water, consisting of ten acres (Colony Ordinance of 1647); but this area was subsequently increased, in the case of the public right of fishing, to twenty acres. (Statutes of 1869, chapter 384, section 7.)

The original grants from the King, in the case of the Colony of Plymouth and the Colony of Massachusetts Bay as well, gave to the colony the title to all lands within the Commonwealth, including great ponds. This provision was also incorporated into the charter of the Province of Massachusetts Bay; and the title to such lands and ponds, unless previously parted with, was, both before and after the Revolution, in the State. “These charters [the several charters to the colonies and the Province] vested in the grantees not only the right of soil, but also large powers of government and the prerogatives of the crown in the sea shores, bays, inlets, rivers and other property which were held for the use and benefit of all the subjects.” (*Watuppa Reservoir Co. v. Fall River*, 147 Mass. 548, 554. See also *Commonwealth v. Roxbury*, 9 Gray 451, 483; *Commonwealth v. Alger*, 7 Cush. 53.)

From a very early period the law of Massachusetts has treated great ponds as of a character closely resembling tide waters, the enjoyment of which for fishing, fowling and other purposes was common to all, and the title in and lands under which could not be made the subject of private ownership without special grant from

the Legislature. (*Paine v. Woods*, 108 Mass. 160; *Ancient Charters*, 148, 149. See also *Commonwealth v. Vincent*, 108 Mass. 441; *West Roxbury v. Stoddard*, 7 Allen, 158.) Thus it was provided in the Colony Ordinance of 1641 that every inhabitant should have free fishing and fowling in any great ponds . . . within the precincts of the town where they dwelt, unless the freemen of the town or the General Court had provided otherwise. (*Body of Liberties*, 1641.) Later, it was provided that no town should appropriate to any person or persons any great pond containing more than ten acres. (Ordinance of 1647.)

These ordinances applied to all great ponds exceeding ten acres in area which in 1647 had not been appropriated to particular persons, either by the freemen of the town or by the General Court. (*West Roxbury v. Stoddard*, *supra*.) The Commonwealth therefore owns the great ponds as public property held in trust for public purposes. It has the ownership of the soil, including, obviously, the soil of islands within the area of such ponds, and also the right to control and regulate the public uses to which the ponds shall be applied. (*Watuppa Reservoir Co. v. Fall River*, 147 Mass. 557.) In such ponds a grant bounded by the pond extends only to low-water mark. (*Waterman v. Johnson*, 13 Pick. 261, 265; *Paine v. Woods*, 108 Mass. 160.) The proprietors of land bordering upon the ponds have no rights in the soil or in the waters, unless it be by grant from the Legislature. (*Watuppa Reservoir Co. v. Fall River*, 147 Mass. 557.)

It follows that the title to lands in great ponds is, in the absence of any grant from the Legislature or from the freemen of a town, prior to 1647, in the Commonwealth. Being lands the title to which is in the Commonwealth, the duties of your Board relating to the same are prescribed by Revised Laws, chapter 96, section 3.

Very truly yours,

HOSEA M. KNOWLTON,
Attorney-General.

TOWN BOUNDARY SURVEY.

In June, the Board, under authority of chapter 469 of the Acts of 1901, assumed the duties pertaining to the Commission on the Topographical Survey and Map of Massachusetts, and has continued the work begun by that commission.

During the first part of the year, up to the time the Topographical Survey Commission was consolidated with this Board, the work was confined to working up the results from the field work of the previous year, and in preparing and superintending the printing of the boundary atlases.

Since then surveys have been made by one party to complete the location of the boundaries in eleven towns in Norfolk County, including the surveys of streams and roads forming boundaries between these and adjoining towns. Another party was employed on similar work in Barnstable, Essex and Middlesex counties a portion of the time, and the balance of the time on the surveys for the Taunton River and Boston harbor canal. The office force has been employed in the preparation of the town boundary atlases, and in calculating the location of the town corners from data furnished by the work of the field parties. The calculations of the position of the town corners determined between the years 1893 and 1900, which were delayed, awaiting the completion of the primary triangulation work on which it was based, have been completed and the location of the corners filed in the card catalogue. The compilation of the statutes defining the boundaries of thirty-four towns has been completed.

Since January 1, atlases of one city and three towns have been published, viz., Springfield, Raynham, Norton and Rehoboth; and atlases of two towns, Arlington and Sandwich, which were partly printed in June, are now in press.

The plan of publication has been changed so as to materially reduce the expense. Instead of publishing an atlas of each town, adjacent towns are grouped together and published in one atlas, and the printing of the pictures of the bounds at the town corners is omitted.

One atlas including the towns of Cohasset, Hingham, Hull and Weymouth, has been prepared, and is now in press.

The town boundary work done during the year has been less than the year before, owing to the diversion of a portion of the employees to the surveys for the Taunton River and Boston harbor canal; but by transferring the employees from one class of work to another, all necessary results of interest to the Commonwealth have been accomplished.

SALE OF MAPS.

During the year, under chapter 57 of the Resolves of 1890, 14 atlases, one folio and 2,527 additional sheets of the State topographical maps have been sold, for \$187.40.

Under chapter 360 of the Acts of 1900, 4 town boundary atlases have been sold for \$15, and 3 Rhode Island and Massachusetts boundary line plans for \$0.96. Two hundred and sixteen atlases were sent to the officers of the various cities and towns, as provided by law. Under chapter 95 of the Resolves of 1891, 10 atlases and 2 extra portfolios have been distributed, 5 of these being sent to free public libraries. The proceeds of the above sales have been paid to the State Treasurer. It was voted to send a set of town boundary atlases to the U. S. Coast and Geodetic Survey office.

The bounds to mark the portions of the boundary lines between the city of Marlborough and the town of Southborough, between the towns of Carver and Wareham, and between the towns of Lynnfield and Saugus, as established by chapters 393, 394 and 407 of the Acts of 1901, have been set by the local authorities, and plans for filing with the Secretary of the Commonwealth, provided for in the various acts, are being prepared.

STATE BOUNDARIES.

During the year the monuments marking the boundary line between Massachusetts and New Hampshire which were found to be missing or to have been displaced when the line was perambulated last year, have been set and replaced.

The monument on Salisbury beach, which was washed out by the storm of November, 1898, was reset in its original location at a lower grade. The Boston & Maine Railroad set certain monuments which were reported displaced, one at the Merrimac branch, and the other at the Nashua & Acton branch of its road; and also furnished and set a new monument at the intersection of the boundary line with its western division main line. These were subsequently examined, and found to be set in the proper location. The filling was replaced around the monument at the Townsend Hill road between Townsend, Mass., and Brookline, N. H., where it had been cut away by the water in flowing down the road. Where the boundary line crosses Lake Monomonic, between the towns of Winchendon, Mass., and Rindge, N. H., the line was not marked for a distance of 6,697 feet. The shores of the lake are being rapidly occupied by summer cottages.

At the suggestion of Hon. J. B. Tennant, of the Governor's Council of New Hampshire, to whom was delegated the duty of co-operating with the Board in this work, it was decided to place three additional monuments along that line: First, a granite monument, similar to those already set on this section of the line, at a point 1,476 feet east of the monument at the road on the westerly side of the lake. Second, a cast-iron post, at a point 3,108 feet further east. This iron post is of the same pattern as those set on the line between Massachusetts and New York. At a point 426 feet east of this post is a wrought-iron bolt, which is set in a small boulder on the line. Third, a stake has been set to mark the location for the third monument, at a point 938 feet east of the cast-iron monument and 1,179 feet west of the monument at the road on the easterly side of the lake. As this point is difficult of access except across the lake, the setting of the monument has been postponed until this winter, when it can be transported on a sled across the ice. The monument is of granite, and similar to the others on this portion of the line, and will be set as soon as the weather permits.

Owing to the pressure of other duties, nothing has been done toward replacing the monuments on the line between Massachusetts and Rhode Island, which were found to be displaced or missing when the line was perambulated last year, but it is proposed to do this work the coming season. Upon its completion the line between Massachusetts and Connecticut will be the only portion of the boundary of the State not fully marked in a permanent manner; and some arrangement should be made to re-run and mark this line, whenever the State of Connecticut shall be ready to take up the matter.

In the report of the Commission on the Topographical Survey and Map of Massachusetts for 1898, the cost of relocating and marking the Connecticut line was estimated to be \$14,000, of which one-half should be paid by each State. This estimate was based on the cost of the work which had been done by them in relocating and marking the line between Massachusetts and New York.

Amount paid into treasury by the Commission on the Topographical Survey and Map of Massachusetts from sale of maps, etc., from Jan. 1, 1901, to June 7, 1901, inclusive, . . .	\$104 95
Amount paid into treasury by Harbor and Land Commission from sale of maps, etc, from June 8, 1901, to Nov. 30, 1901, inclusive,	98 41
Total,	<u>\$203 36</u>

PROVINCE LANDS.

Three years ago the Legislature appropriated \$10,000 to be spent during the succeeding three years in the improvement of the Province Lands.

It is now eight years since the care of the Province Lands was committed to the Board for reclamation. In that time the Legislature has appropriated \$23,000. With the expenditure of that money about 170 acres of the blowing sands have been reclaimed and protected from movement by the violence of the winds. Also from that fund a much-needed road, about 10,200 feet long, has been built across the sand barrens to the Race Point life-saving station, at a cost of about \$3,450, or a little less than 34 cents a running foot.

The reports of the superintendent under whose supervision this work has been performed have been published in the annual reports of the Board from year to year. Their perusal will show the steady although necessarily slow improvement which has been effected during the period of his care.

The progress of the work has been viewed by scientific men from the agrostological department at Washington and elsewhere with great interest. The results have fully answered expectations, and the method of reclamation adopted has met with unqualified approval.

In order to complete the work, it will be desirable to reclaim about 115 acres more of the sand barrens, after which there need be no apprehension of danger from the blowing of the sands on the lands of the Commonwealth. The shrubs and young trees are growing up among the beach grass, and are doing extremely well.

The sum of \$68.36 has been collected during the season, and turned over to the Treasurer of the Commonwealth.

The appropriation is exhausted to an unexpended balance in the treasury of 21 cents, and, unless renewed at the coming session of the Legislature, further improvement and care of the lands will have to be discontinued.

The report* of the Superintendent of the Province Lands may be found in the Appendix.

WRECKS.

Under chapter 260 of the Acts of 1883, the Board is authorized to remove wrecks and other obstructions from tide waters. The work done during the year is as follows:—

A portion of a small vessel lying on the water pipes of the Metropolitan Water Board was removed from Chelsea Creek in March and April, under an agreement with Alfred S. Sorensen, at a cost of \$50.

Forty-seven ancient piles, forming part of the old bridge which formerly connected the westerly end of Breed's Island with Chelsea, and was removed many years ago, were complained of as causing an obstruction to navigation in Chelsea Creek, and were taken up in April, under an agreement with W. H. Wyman, at a cost of \$228.

A large boulder in Charles River, opposite Hoosac Tunnel docks, liable to cause wrecks, was removed in May, under an agreement with Geo. W. Townsend, at a cost of \$75.

On July 23 a request was received from the city engineer of Gloucester for an inspection of Gloucester harbor, with a view to removing certain ledges and boulders which were obstructing navigation. After a conference with the city engineer, August 15, it appeared that the boulders complained of were situated at the entrance to a private slip, where they obstructed the passage of vessels only to and from that particular wharf; the Board therefore did not consider it to be a case that called for action by the State. The ledges complained of were found to be so large and extensive that the Board did not feel justified in undertaking their removal without further legislation.

In September complaint was received that in rebuilding the bridge in the highway between Wareham and Marion,

* See Appendix C.

over the Weweantitt River, the contractor had broken or cut off the piles of the old bridge at or about the level of low water, and that a considerable number of them were a serious obstruction, and dangerous to small boats passing under the new bridge. After investigation, the matter was brought to the attention of the State Highway Commission, under whose direction the work was being done, and the obstructions were removed.

Also a large boulder projecting above the bottom of Boston harbor, at a point about 50 feet from the southerly corner of Central wharf, was removed in October, under an agreement with Geo. W. Townsend, at a cost of \$46.

The attention of the Board was called to the fact that the wharf of the Plymouth Stove Company at Plymouth was in a dilapidated condition, and rapidly being washed away by the sea into the channel. Upon notice to the company that injury threatened the channel, repairs were finally made.

SURVEYS.

The work done by the Engineering Department during the last year has been larger than that of any previous year, and the number of employees has been proportionately increased during the summer season.

In addition to the work on the Commonwealth flats at South Boston, special surveys were made of the mouth of Bass River in Dennis and Yarmouth, Herring River in Harwich, and Apponagansett harbor in Dartmouth, under the Resolves of 1901, with a view to determining what improvements could be made at these places; also a survey, under chapter 104 of the Resolves of 1901, for the purpose of estimating the probable cost of constructing a canal from Taunton River to Boston harbor, which included the examination and mapping of the route, 40 miles long.

Other surveys have been made in connection with the general work of the Board, as follows:—

In December, 1900, the surveys of Bird Island shoal, as a basis for making plans for an anchorage basin, were completed.

December 13, a survey was made of the area which had been dredged as a berth for the nautical training ship

“Enterprise” at North End Park, to ascertain if the excavation had been properly completed.

December 19, a survey was made to ascertain the amount of filling which had been placed by the contractor in rear of the concrete sea wall built at the Sand Hills in Scituate.

In December, 1900, and January, 1901, surveys were made of a portion of Fort Point Channel, from Congress Street bridge to Rowe’s wharf, preparatory to contracting for dredging to a depth sufficient to accommodate the increased size of vessels coming to the wharves in this locality. In May surveys of the same territory were made upon the completion of the dredging.

January 2 and 4, a survey was made to ascertain the extent of certain obstructions caused by piles in an old bridge which formerly crossed Chelsea Creek, opposite Breed’s Island.

February 5, levels were taken to ascertain the elevation of the bench marks which had been placed on Congress Street bridge by the superintendent, showing the heights reached by the water during storms.

In February, March and April, the plane table survey of Mystic River was continued, some of the earlier sheets of the river were corrected and brought up to date in locations where extensive changes and improvements had been made, and two additional sheets completed.

March 25 to 28, a survey was made of the channel in Plymouth harbor, at the point just south of Long Beach, with a view to straightening the channel by cutting off a portion of the bend.

In April and June, surveys were made at Point Shirley and Shirley Gut, preparatory to excavating the shoaling which had taken place, also of the location of the dredging which had been done.

May 9 to 14, a survey was made of the channel of Winthrop harbor, to ascertain the location of shoals.

May 16 to 18, a survey was made of the channel which had been excavated into West Bay at Osterville, to determine what changes had taken place.

May 27 to 30, a survey was made at Lake Anthony, in Cottage City, as a basis for planning the work of excavating the anchorage, and of the approaches to the landing.

May 29, a survey was made of property on Chelsea Creek, in Chelsea, formerly owned by White, Holman & Co., to ascertain the amount of tide water which had been displaced. June 10 to 12, a survey was made of the entrance channel at Green Harbor, to determine what changes had taken place.

June 25 to 27, a survey was made of Stony beach, in Hull, preparatory to making plans for a sea wall to protect the beach.

In August, September and October surveys were made relative to the work of improvement at Lake Anthony.

September 16, a survey was made of the embankment which the Old Colony Railroad Company had built across South Bay, to ascertain the amount of tide water which had been displaced thereby.

September 19 to 21, a survey was made of Menamsha Creek, in Chilmark, to determine what changes had taken place since the construction of jetties by the Commonwealth.

October 31, a survey was made of shoals in Boston harbor near Union wharf.

INSPECTIONS MADE BY THE BOARD DURING THE YEAR.

1900.

Dec. 7. Commonwealth flats at South Boston.

1901.

Feb. 4. Stony beach, in Hull, in company with legislative committee, relative to proposed protective works.

Mar. 22. Boston harbor and proposed anchorage ground at Bird Island shoal, in company with legislative committee.

Mar. 29. Commonwealth flats at South Boston.

April 5-6. Entrance to Bass River, in Dennis and Yarmouth, under authority of chapter 39 of the Resolves of 1901.

Jetties and channel at Osterville, relative to condition of work done under direction of the Board.

April 9. Protective works on the Connecticut River, in Hadley and Northampton.

April 17. Commonwealth flats at South Boston.

April 25. Work in progress at Union wharf.

April 29. Site of proposed structures in Buzzards Bay, at Monument beach.

1901.

- April 30. Work in progress on survey of entrance to Bass River, in Dennis and Yarmouth, authorized by chapter 39 of the Resolves of 1901.
- May 2-3. Banks of the Connecticut River, in Northampton and Hadley, with legislative committee, relative to protective work.
- May 4. Work done at outlet of Maquan Pond, in Hanson.
- May 8. Wharf property of the Boston Fire Brick and Clay Retort Manufacturing Company and the Boston Electric Light Company, at L Street, in South Boston.
- May 9. Commonwealth flats at South Boston, and proposed site of Northern Avenue and bridge, in company with legislative committee.
- May 17. Concrete sea wall on the beach at the Sand Hills, in Scituate, built under direction of the Board; also other localities in Scituate where it is desired to have the Board do certain work under chapter 434 of the Acts of 1900.
- New mouth of North River, in Scituate.
- May 24-25. Witchmere harbor, in Harwich, relative to condition of work done under direction of the Board.
- Herring River, in Harwich, relative to improvement authorized by chapter 66 of the Resolves of 1901.
- Entrance to Bass River.
- Jetties and channel at West Bay, in Osterville.
- May 28. Structure in tide water near the railroad station at West Manchester, on complaint made by property owners.
- June 7. Site of proposed work of New England Gas and Coke Company on Island End River, in Everett.
- June 29. Work done by the Commonwealth on the Province Lands in Provincetown.
- July 12-13. Apponagansett harbor, relative to survey authorized by chapter 38 of the Resolves of 1901, and Lake Anthony, in Cottage City, relative to further improvements.
- July 16. Location for canal near Brockton, under chapter 104 of the Resolves of 1901.
- July 18-19. Banks of the Connecticut River at Northampton and Hadley, relative to a continuation of the protective work in Hadley authorized by chapter 94 of the Resolves of 1901.

1901.

- July 23. Stony beach in Hull, relative to location of sea wall authorized by chapter 483 of the Acts of 1901.
Location of proposed canal line between Weymouth and Holbrook.
- July 25. Work of filling the parkway on Charles River, near Brookline bridge, in Cambridge.
- July 31. Location of proposed canal line between Taunton and West Bridgewater.
- Aug. 5. Structures in Lake Chaubunagungamaug, in Webster.
- Aug. 6. Commonwealth flats at South Boston.
- Aug. 14-15. Work of setting buoys and dredging in Lake Anthony, at Cottage City.
Jetties and channel at Menamsha Inlet, relative to work done under direction of the Board.
- Aug. 19. Work of placing a monument on Salisbury beach, marking the boundary line between Massachusetts and New Hampshire.
- Aug. 25. Jetties and channel at West Bay, Osterville, relative to work done under the direction of the Board.
- Aug. 27. Structures projecting beyond the harbor line on Merrimac River, in Haverhill.
- Aug. 28. Bridges over Weweantitt River and Wankinco River, in Wareham.
- Aug. 29-30. Protective work in progress on the bank of the Connecticut River at Hadley, under direction of the Board, and work done at West Springfield.
- Sept. 4. Commonwealth flats at South Boston.
- Sept. 9. Work done under the direction of the Board at Witchmere harbor, in Harwich; entrance to Bass River, in Dennis and Yarmouth, relative to further surveys.
- Sept. 12. Lake Anthony, in Cottage City, relative to work in progress, under direction of the Board.
- Sept. 24. Work in progress on survey for proposed canal between Taunton and Somerset.
- Sept. 26. Cedar Pond and Dunham Pond, in Carver, relative to petitions for authority to take water from said ponds for flowing cranberry bogs.
- Sept. 28. Protective work in progress on the bank of the Connecticut River in Hadley, under direction of the Board.
- Oct. 3. Ragged Island in Hingham harbor.
- Oct. 11. Commonwealth flats at South Boston.

1901.

- Oct. 18. Work done by the Commonwealth on the Province Lands in Provincetown.
- Oct. 19. East Bay in Osterville.
- Oct. 22. Property of Fore River Ship and Engine Company, on Weymouth Fore River, in Quincy.
- Oct. 23. Commonwealth flats at South Boston.
- Oct. 24. Structures and sites of proposed sewer outlets in Plymouth harbor.
- Oct. 26. Protective work in progress on the bank of the Connecticut River in Hadley, under direction of the Board.
- Nov. 9. Mouth of Scorton harbor, in Sandwich, relative to condition of work done under authority of chapter 442 of the Acts of 1898.

LICENSES GRANTED DURING THE YEAR.

Nos.

2434. Petition of Jens Bertelsen and John P. Petersen for license to fill solid in Boston harbor at East Boston. Granted Dec. 3, 1900.
2435. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to reconstruct a portion of the westerly side of its Pier No. 1 in Boston harbor at East Boston. Granted Dec. 4, 1900.
2436. Petition of the Suburban Gas and Electric Company for license to build and maintain a pile wharf, construct a crib, lay pipes and dredge a basin in Chelsea Creek in the town of Revere. Granted Dec. 27, 1900.
2437. Petition of the Lynn & Boston Railroad Company for license to dump snow and ice into Mystic River from Chelsea bridge over the north channel of said river. Granted Jan. 7, 1901.
2438. Petition of Matthew J. Connors and James E. Cavanagh for license to build and maintain a pile wharf and dredge a channel in Weymouth Fore River at Hough's Neck in the city of Quincy. Granted Jan. 7, 1901.
2439. Petition of Michael J. Kane for license to build and maintain an ice run in Dorothy Pond in the town of Millbury. Granted Jan. 7, 1901.
2440. Petition of Hannah G. Shaw for license to build and maintain retaining walls and fill solid in East River in the town of Wareham. Granted Jan. 7, 1901.

Nos.

- 2441. Petition of Nathan F. Tufts and others for license to build a bulkhead and fill solid in Mystic River, adjoining Charlestown Park, in the city of Boston. Granted Jan. 7, 1901.
- 2442. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to widen and extend its Pier No. 7 in Boston harbor at East Boston. Granted Jan. 7, 1901.
- 2443. Petition of Henry W. Smith for license to build a bulkhead and fill solid in Chelsea Creek, adjoining Marginal Street, in the city of Chelsea. Granted Jan. 7, 1901.
- 2444. Petition of Cashman Brothers for license to build a bulkhead and pile fenders, to extend wharf and fill solid in Merrimac River in the city of Newburyport. Granted Jan. 7, 1901.
- 2445. Petition of Albin Leal Richards for license to fill solid in Mystic River at his wharf adjoining Medford Street in the city of Boston. Granted Jan. 9, 1901.
- 2446. Petition of Henry H. Fay for license to build and maintain a wharf, partly solid and partly on piles, in Wood's Hole Great Harbor, at Wood's Hole in the town of Falmouth. Granted Jan. 11, 1901.
- 2447. Petition of Willard Howland for license to fill solid and build a pile platform in Chelsea Creek at East Boston. Granted Jan. 25, 1901.
- 2448. Petition of the Trustees of Fiske Wharf and Warehouse Trust for license to build a bulkhead and pile structure and fill solid in a dock adjoining Fiske wharf in the city of Boston. Granted Feb. 4, 1901.
- 2449. Petition of the Board of Metropolitan Sewerage Commissioners for approval of plans for constructing a sea wall and pile platform, and for filling solid in Chelsea Creek at East Boston, as authorized by chapter 439 of the Acts of 1899. Granted Feb. 28, 1901.
- 2450. Petition of the Boston Electric Light Company for approval of plans for laying a cable across Fort Point Channel at Dover Street bridge in the city of Boston, under authority of chapter 249 of the Acts of 1898. Granted Feb. 28, 1901.
- 2451. Petition of the Board of Metropolitan Park Commissioners for license to excavate, fill solid and change the southwesterly shore line of Charles River, in the city of Boston, from near Boylston Street bridge to a point opposite the Cambridge Hospital grounds. Granted Feb. 28, 1901.

Nos.

2452. Petition of the city of Boston for license to build a pile wharf for the support of a coal shed in Boston harbor at the South Ferry in East Boston. Granted Feb. 28, 1901.
2453. Petition of the Metropolitan Steamship Company for license to widen and extend Union wharf on piles in Boston harbor in the city of Boston. Granted Feb. 28, 1901.
2454. Petition of Job L. Cole for license to build and maintain an ice run in Fresh Pond in the town of Plymouth. Granted Feb. 28, 1901.
2455. Petition of the Boston Fire Brick and Clay Retort Manufacturing Company for license to extend two pile wharves and fill solid in Boston harbor, near the Reserved Channel at South Boston. Granted March 7, 1901.
2456. Petition of Edward W. Chadwick for license to extend his pile pier in Edgartown harbor at Chappaquiddick in the town of Edgartown. Granted March 7, 1901.
2457. Petition of the Massachusetts Pipe Line Gas Company for approval of plans for building pile structures and laying a gas main in, over and under Island End River in the cities of Everett and Chelsea, under authority of chapter 537 of the Acts of 1896. Granted March 7, 1901.
2459. Petition of the South Bay Company for license to fill solid in South Bay in the city of Boston. Granted March 15, 1901.
2460. Petition of the Hanley Construction Company for license to build and maintain a wharf, partly solid and partly on piles, on Town River in the city of Quincy. Granted March 18, 1901.
2461. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to rebuild its sea wall at the head of Dock No. 1, Grand Junction wharves, at East Boston. Granted March 18, 1901.
2462. Petition of the city of Boston for license to widen Alford Street by filling solid, and to riprapi the slope of said filling in Mystic River in the city of Boston. Granted March 18, 1901.
2463. Petition of Thomas E. Reed for license to widen and extend his wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted March 18, 1901.
2464. Petition of Catherine A. Meston for license to build and maintain a pier in Mattapoisett harbor in the town of Mattapoisett. Granted March 18, 1901.

Nos.

2465. Petition of the New Bedford & Onset Street Railway Company for license to fill solid in Wareham River in the town of Wareham. Granted March 20, 1901.
2466. Petition of Julia W. Lowry for license to build and maintain a pile pier and float stage in Buzzards Bay at Josiah's Point in the town of Wareham. Granted March 25, 1901.
2467. Petition of Frederic S. Goodwin for license to extend his wharf, on piles, in Boston harbor at East Boston. Granted March 29, 1901.
2468. Petition of the Providence & Fall River Street Railway Company for license to build a pile bridge across Palmer's River and to fill solid in adjacent creeks in the town of Swansea. Granted April 3, 1901.
2469. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to enlarge its Pier No. 1 and Dock No. 2 and build a sea wall and pile platform in Boston harbor at East Boston. Granted April 4, 1901.
2470. Petition of the Trustees of the Hingham and Quincy Bridges for license to widen a portion of the present bridge on Weymouth Back River in the town of Hingham. Granted April 4, 1901.
2471. Petition of the town of Ipswich for license to build a sea wall and fill solid in Ipswich River in the town of Ipswich. Granted April 5, 1901.
2472. Petition of the city of Boston for license to rebuild the piers and wharves, on piles, at the East Boston landing of the South Ferry in Boston harbor. Granted April 15, 1901.
2473. Petition of the Metropolitan Water and Sewerage Board for approval of plans for laying pipes in Boston harbor from Nut Island, building a pile wharf and constructing embankments, in the city of Quincy and town of Hull, as directed by chapter 424 of the Acts of 1899. Granted April 17, 1901.
2474. Petition of William H. Norton for license to build and maintain a pile pier in Edgartown harbor in the town of Edgartown. Granted April 17, 1901.
2475. Petition of the Massachusetts Highway Commission, acting under authority of chapter 497 of the Acts of 1894 and acts amendatory thereto, for license to rebuild two bridges over the Weweantitt River in the towns of Marion and Wareham. Granted April 30, 1901.

Nos.

2476. Petition of Frank Stanwood for license to extend his wharf, on piles, in Gloucester harbor in the city of Gloucester. Granted April 30, 1901.
2477. Petition of the Board of Park Commissioners of Arlington for license to build a dam, sluiceway and screen at the mouth of Mill Brook at Mystic Lake in the town of Arlington. Granted April 30, 1901.
2478. Petition of the town of Marblehead for license to build a sea wall and fill solid in Nick's Cove in the town of Marblehead. Granted May 3, 1901.
2479. Petition of the town of Bourne for license to build a sea wall and fill solid in Cohasset Narrows in the town of Bourne. Granted May 3, 1901.
2480. Petition of William F. Macy and John P. Fitts for license to build and maintain a pile wharf in Quincy Bay at Hough's Neck in the city of Quincy, and to dredge a basin and channel leading to said wharf. Granted May 3, 1901.
2481. Petition of Alfred S. Sorensen for license to build a wharf, partly solid and partly on piles, in Chelsea Creek, adjoining Marginal Street in the city of Chelsea. Granted May 10, 1901.
2482. Petition of George H. Richards and Howard Stockton, trustees of the Toby Club, for license to build and maintain a pile wharf, ways, dolphins and landing float, and to dredge in Buzzards Bay at Monument beach in the town of Bourne. Granted May 10, 1901.
2483. Petition of the Corinthian Yacht Club for license to build and maintain a wharf and landing stage in Marblehead harbor at Marblehead Neck in the town of Marblehead. Granted May 10, 1901.
2484. Petition of William H. Moore and Edwin C. Swift for license to build and maintain a pile pier and float, also to lay and maintain an iron pipe for drainage purposes in Salem harbor in the city of Beverly. Granted May 10, 1901.
2485. Petition of Albin Leal Richards for license to fill solid and extend his wharf, on piles, in Mystic River in the city of Boston. Granted May 10, 1901.
2486. Petition of the city of Cambridge, by its Board of Park Commissioners, for license to fill solid in Charles River, between points 240 feet east and 670 feet west of Putnam Avenue. Granted May 10, 1901.

Nos.

2487. Petition of Benjamin F. Brown, trustee, the heirs of Nancy Lennon, Henry O. Marcy, Jennie G. Carter, Noah S. King, James A. Norcross and Orlando W. Norcross, for license to fill solid in Charles River between land of the Boston & Albany Railroad Company and land of Charles H. Souther and others in the city of Cambridge. Granted May 10, 1901.
2488. Petition of the city of Boston for license to repair and reconstruct the draw landing and fender on the South Boston side of Mt. Washington Avenue bridge on Fort Point Channel. Granted May 10, 1901.
2489. Petition of Eugene T. Adams and James F. Ring, co-partners under the firm name of Simonds & Adams, for license to build a sea wall and fill solid in Merrimac River in the city of Haverhill. Granted May 13, 1901.
2490. Petition of Reed & Gamage for license to build and maintain a pile wharf in Gloucester harbor in the city of Gloucester. Granted May 14, 1901.
2491. Petition of George F. Welch for license to widen and extend his wharf in Scituate harbor in the town of Scituate. Granted May 14, 1901.
2492. Petition of Samuel W. K. Brooks for license to rebuild, widen and extend his wharf, on piles, and to build launch ways in Boston harbor at Harbor View, East Boston. Granted May 16, 1901.
2493. Petition of the city of Boston for license to drive additional piles in the middle pier of the North Ferry, Boston landing. Granted May 27, 1901.
2494. Petition of the Gloucester Fish Drying Company for license to build and maintain a pile pier on Annisquam River in the city of Gloucester. Granted May 27, 1901.
2495. Petition of Robert W. Emmons, 2d, for license to build and maintain two pile piers and floats in Buzzards Bay at Mashnee Island. Granted June 3, 1901.
2496. Petition of the town of Wareham for license to rebuild and widen the highway bridge across the Wankinco River at Wareham Narrows. Granted June 3, 1901.
2497. Petition of the New Bedford & Onset Street Railway Company for approval of plans for building a pile bridge over the Wareham River at the Narrows, below the present highway bridge and westerly of and adjacent to the location of the New York, New Haven & Hartford Railroad Company, as authorized by chapter 132 of the Acts of 1901. Granted June 5, 1901.

Nos.

2498. Petition of the Brockton & Plymouth Street Railway Company for license to build and maintain a runway, on piles, and a float in Little Sandy Bottom Pond in the town of Pembroke. Granted June 5, 1901.
2499. Petition of the town of Marblehead for license to build a wharf in Marblehead harbor at Red Stone Cove. Granted June 12, 1901.
2500. Petition of Jennie W. Bliss for license to build and maintain a pile pier and float in Marion harbor in the town of Marion. Granted June 12, 1901.
2501. Petition of the Soule Mill for license to build bulkheads and fill solid in Acushnet River in the city of New Bedford. Granted June 14, 1901.
2502. Petition of the Board of Public Works of the city of New Bedford for license to build and maintain a six-foot brick sewer, on piles, in Acushnet River, in extension of the sewer built in Sawyer Street, in the city of New Bedford. Granted June 14, 1901.
2503. Petition of Edwin A. Grozier for license to build and maintain a boat house on piles at the south-easterly end of Central wharf in Provincetown harbor in the town of Provincetown. Granted June 14, 1901.
2504. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for approval of plans for building a pile bridge over Swift's River at Point Independence in the town of Wareham, as authorized by chapter 344 of the Acts of 1901. Granted June 19, 1901.
2505. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for approval of plans for building a pile bridge over Buttermilk Bay in the towns of Wareham and Bourne, as authorized by chapter 344 of the Acts of 1901. Granted June 19, 1901.
2506. Petition of the Brockton & Plymouth Street Railway Company for license to place poles in Plymouth harbor in the town of Plymouth, for the purpose of an overhead transmission line. Granted June 20, 1901.
2507. Petition of the Edison Electric Illuminating Company of Boston for license to build a sea wall and fill solid in Fort Point Channel in the city of Boston. Granted June 24, 1901.
2508. Petition of Henry A. Leonard, trustee, for license to build a wharf in Buzzards Bay in the town of Dartmouth. Granted June 26, 1901.

Nos.

2509. Petition of Grace F. Allen for license to build a pile pier in Little Sandy Bottom Pond in the town of Pembroke. Granted June 26, 1901.
2510. Petition of James F. Smith, trustee, for license to build and maintain a pile pier in Priest's Cove at Pope beach in the town of Fairhaven. Granted June 26, 1901.
2511. Petition of the East Boston Athletic Association Boat Club for license to drive piles for the support of a boat house in Chelsea Creek, adjoining Meridian Street bridge at East Boston, and to maintain runways, a float and a floating bath house. Granted June 26, 1901.
2512. Petition of Felix Rackemann for license to build and maintain a pile pier and floats in Katama Bay in the town of Edgartown. Granted July 3, 1901.
2513. Petition of the Misery Island Club for license to build and maintain a pile pier and float in Salem harbor at Misery Island. Granted July 3, 1901.
2514. Petition of Cornelia S. Chapin for license to build a pile pier in Edgartown harbor in the town of Edgartown. Granted July 3, 1901.
2515. Petition of the Edison Electric Illuminating Company of Boston for license to extend its wharf, on piles, on Fort Point Channel in the city of Boston. Granted July 3, 1901.
2516. Petition of the Metropolitan Steamship Company for license to build a sea wall and to remove a portion of Union wharf in Boston harbor in the city of Boston. Granted July 3, 1901.
2517. Petition of the estate of John Manners for license to build a timber wharf and fill solid in Merrimac River in the city of Haverhill. Granted July 8, 1901.
2518. Petition of the city of Haverhill for license to build a timber wharf and fill solid in Merrimac River in the city of Haverhill. Granted July 8, 1901.
2519. Petition of Stefano Gardella for license to build a timber wharf and fill solid in Merrimac River in the city of Haverhill. Granted July 8, 1901.
2520. Petition of the city of Boston for approval of plans for building a temporary foot-bridge and fender across Fort Point Channel at Broadway bridge, under authority of chapter 452 of the Acts of 1900. Granted July 8, 1901.

Nos.

2521. Petition of the East Boston Gas Company for approval of plans for building a pile structure for the support of a gas main across Chelsea Creek in the city of Boston and town of Winthrop, under authority of chapter 228 of the Acts of 1901. Granted July 10, 1901.
2522. Petition of the Board of Metropolitan Park Commissioners for license to fill solid in Charles River and change the northerly shore line in the town of Watertown, between points 2,500 and 3,900 feet westerly from North Beacon Street bridge. Granted July 16, 1901.
2523. Petition of the United States Steel Company for license to build a bulkhead and fill solid in a creek flowing into Malden River in the city of Everett. Granted July 18, 1901.
2524. Petition of Alice V. McAloon for license to build and maintain a pile pier and float stage in Buzzards Bay at Long Neck in the town of Wareham. Granted July 18, 1901.
2525. Petition of the Philadelphia & Reading Coal and Iron Company for license to build a sea wall and fill solid in a dock on Acushnet River in the city of New Bedford. Granted July 29, 1901.
2526. Petition of the New Bedford Gas and Edison Light Company for license to build a sea wall and fill solid in a dock on Acushnet River in the city of New Bedford. Granted July 29, 1901.
2527. Petition of the Quincy Electric Light and Power Company for license to extend its wharf, on piles, and to dredge in Town River in the city of Quincy. Granted July 29, 1901.
2528. Petition of Caroline E. Bates for license to build a pier in Buzzards Bay in the town of Dartmouth. Granted July 29, 1901.
2529. Petition of the West End Street Railway Company for license to build bulkheads and fill solid in Chelsea Creek at East Boston. Granted July 31, 1901.
2530. Petition of the West End Street Railway Company for license to build a sea wall or bulkhead and pile wharf and fill solid in Mystic River at Charlestown in the city of Boston. Granted July 31, 1901.
2531. Petition of the Boston Elevated Railway Company for license to build a sea wall and concrete piers, fill solid, widen its wharf on piles, and dredge in Boston harbor at Lincoln wharf in the city of Boston. Granted July 31, 1901.

Nos.

2532. Petition of Edward N. Pigot for license to build and maintain a pile pier and float in Buzzards Bay in the town of Wareham. Granted Sept. 10, 1901.
2533. Petition of Arthur M. Phillips for license to build and maintain a pile pier and float stage in Onset Bay in the town of Wareham. Granted Sept. 10, 1901.
2534. Petition of the Beacon Park Company for license to maintain a pile and timber wharf, also a pile wharf and floats, in Lake Chaubunagungamaug in the town of Webster. Granted Sept. 10, 1901.
2535. Petition of Robert G. Shaw for license to build and maintain a pile wharf in Vineyard Haven harbor at West Chop in the town of Tisbury. Granted Sept. 10, 1901.
2536. Petition of the Hanley Construction Company for license to build pile structures in Town River in the city of Quincy. Granted Sept. 10, 1901.
2537. Petition of the city of Gloucester for approval of plans for laying a water pipe across Squam River in the city of Gloucester, under authority of chapter 451 of the Acts of 1895. Granted Sept. 23, 1901.
2538. Petition of the Boston & Albany Railroad, the New York Central & Hudson River Railroad Company, lessee, for license to remove Pier No. 3, Grand Junction wharves, and to enlarge and reconstruct Pier No. 4 and adjoining dock, in Boston harbor at East Boston. Granted Sept. 23, 1901.
2539. Petition of the city of Boston for approval of plans for building a temporary foot-bridge across Fort Point Channel at Broadway bridge in the city of Boston, under authority of chapter 452 of the Acts of 1900. Granted Sept. 25, 1901.
2540. Petition of Robert Treat Paine, 2d, trustee, for license to build a boat landing in Massachusetts Bay in the town of Manchester. Granted Sept. 25, 1901.
2541. Petition of David B. Newcomb, Jr., for license to build a sea wall or dam across the entrance to a dock in Sandy Bay in the town of Rockport. Granted Oct. 2, 1901.
2542. Petition of Albert C. Burrage for license to build a pile wharf in Boston harbor at Bumkin Island in the town of Hull. Granted Oct. 2, 1901.
2543. Petition of the town of Dartmouth for approval of plans for reconstructing the bridge over the Apponagansett River at the village of South Dartmouth, under authority of chapter 384 of the Acts of 1901. Granted Oct. 2, 1901.

Nos.

2544. Petition of the Orient Heights Yacht Club for license to drive piles in Boston harbor at East Boston, for the support of a club house. Granted Oct. 3, 1901.
2545. Petition of the Boston, Revere Beach & Lynn Railroad Company for license to fill solid a portion of its pile bridge, to rebuild a portion of the same and construct a double-track trestle, in Crystal Cove in the town of Winthrop. Granted Oct. 7, 1901.
2546. Petition of the county commissioners of Norfolk County for approval of plans for constructing a bridge, with approaches, across Weymouth Fore River, substantially replacing the present bridge at Quincy Point, under authority of chapter 456 of the Acts of 1900. Granted Oct. 9, 1901.
2547. Petition of Robert Winsor for license to build and maintain a pile pier and float and a marine railway, also to fill solid, in Red Brook harbor at Rocky Island in the town of Bourne. Granted Oct. 10, 1901.
2548. Petition of the East Boston Dry Dock Company for license to widen and rebuild, on piles, a portion of its northerly pier in Boston harbor at East Boston. Granted Oct. 10, 1901.
2549. Petition of the Boston Elevated Railway Company for license to dump snow and ice into tide waters. Granted Oct. 29, 1901.
2550. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River from the yard of the Fitchburg Railroad Company at the foot of Haverhill Street in the city of Boston. Granted Oct. 29, 1901.
2551. Petition of Peter T. Fallon and others for license to build a sea wall and fill solid in Town River in the city of Quincy. Granted Oct. 29, 1901.
2552. Petition of Ensign K. Tewksbury and others for license to fill solid in the basin north of Washington Avenue in the town of Winthrop. Granted Oct. 30, 1901.
2553. Petition of the Middleborough, Wareham & Buzzards Bay Street Railway Company for license to extend the easterly abutment of the bridge across Swift's River at Point Independence in the town of Wareham. Granted Nov. 5, 1901.
2554. Petition of the New Bedford Yacht Club for license to build and maintain a pile pier and float stage in Apponaugansett harbor in the town of Dartmouth. Granted Nov. 5, 1901.

Nos.

2555. Petition of the county commissioners of Essex County for approval of plans for constructing a new bridge and approaches across Merrimac River between the city of Newburyport and the town of Salisbury, under the provisions of chapter 483 of the Acts of 1896 and chapters 517 and 526 of the Acts of 1901. Granted Nov. 8, 1901.
2556. Petition of the city of Boston for license to dump snow and ice into tide waters. Granted Nov. 11, 1901.
2557. Petition of the Fore River Ship and Engine Company for license to build wharves, piers, marine railway, and to fill solid and dredge in Weymouth Fore River and Bent's Creek in the city of Quincy. Granted Nov. 14, 1901.
2558. Petition of the Boston & Maine Railroad for license to extend Pier No. 5, Hoosac Tunnel docks, on piles, on Charles River in the city of Boston. Granted Nov. 27, 1901.

PETITIONS DENIED.

On Dec. 19, 1900, in the matter of the petition of Albin Leal Richards for license to build two pile wharves and a bulkhead, and to fill solid on Mystic River in Charlestown, the Board declined to grant a license in the manner and form requested by the petitioner, but subsequently a license was granted in modified form, upon filing an amended plan.

On January 16, S. A. Thayer and Wm. M. Stetson, petitioners for license to fill solid in Great Pond in the town of Braintree, were granted leave to withdraw, as the town, represented by the selectmen, and the water board, opposed the granting of a license, on the ground that the Legislature has authorized the use of the waters of this pond for domestic purposes and that the granting of the desired license would be detrimental to public interests.

On February 11, Walter S. Gordon, petitioner for lease of an island in Morse's Pond in Wellesley, was given leave to withdraw, as the granting of an exclusive use of the same would be contrary to public policy.

On April 12, the Board refused to authorize the Bay State Dredging Company to dump material dredged from Nantasket Channel on flats lying between White Head and Strawberry Hill, in Hull, being of the opinion that the material should be dumped at sea.

On April 30, the Board declined to lease an island in the town of Billerica.

On May 13, the Board declined to permit the removal of material from Green Island in Boston harbor.

On June 4, the Board declined to permit the removal of material from a beach in Marblehead harbor.

On June 12, George L. Stacy, petitioner for license to build a wall and fill solid in Wonson's Cove, in Gloucester, was granted leave to withdraw, the title of the petitioner to the land in question being in dispute.

On July 1, the Board, acting with the Railroad Commissioners, as a joint Board, refused to grant the petition of the Boston, Cape Cod & New York Canal Company for authority to issue stock and bonds, as previously stated on page 56.

On August 1, the Board declined to approve an amendment of section 3, chapter 38 of the Revised Ordinances of the city of Boston, relating to the passage of vessels through the draw in Charlestown bridge, on Charles River, as previously stated on page 23.

On August 15, the Board declined to remove certain boulders from Gloucester harbor, located at the entrance to a private slip, as previously stated on page 83.

On October 9, the Board decided, after full hearing, to take no action at present on the petition of Z. A. Tillson & Son, asking that license No. 1360, granted by the Board to Peleg McFarlin, authorizing the building of structures and drawing of water from Cedar Pond in Carver, be revoked.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

POINT SHIRLEY CLUB, to dredge gravel from its flats at Point Shirley, in the town of Winthrop. Granted Dec. 3, 1900.

NEW ENGLAND DREDGING COMPANY, to dredge not exceeding 100,000 cubic yards of gravel in Boston harbor westerly of Lovell's Island. Granted Dec. 20, 1900.

J. N. SMITH & Co., to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Jan. 1, 1901.

PETER McCONARTY, to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Jan. 1, 1901.

ESTATE OF PATRICK O'RIORDEN, to use a portion of the Commonwealth flats at South Boston for storage purposes. Granted Jan. 1, 1901.

EDITH ANDREW, and Edith Andrew as trustee, to remove gravel from the beach at the south-easterly end of Prince's Head, a part of Peddock's Island in Boston harbor. Granted Feb. 14, 1901.

TRUSTEES OF THE MAIN STREET LAND TRUST, to dredge material from their flats in Charles River, on the Cambridge side of the channel, near West Boston bridge. Granted Feb. 18, 1901.

SAMUEL JAMES, 2d, to remove stone from the beach at Sheep Island in Boston harbor. Granted Feb. 28, 1901.

CITY OF HAVERHILL, to lay and maintain a cable on the bottom of Merrimac River, across the drawways in Haverhill bridge. Granted March 8, 1901.

JOSEPH L. BOARDMAN, to remove gravel from Salter's beach at Gurnet Point, in the town of Plymouth. Granted March 25, 1901.

TOWN OF HADLEY, to repair and protect the banks of the Connecticut River in Hadley. Granted April 12, 1901.

COLE BROTHERS, to dump material dredged at the site of the New Bedford and Fairhaven bridge, at North Ledge in New Bedford harbor. Granted April 15, 1901.

BOSTON, PLYMOUTH & PROVINCETOWN STEAMBOAT COMPANY, to dredge in Provincetown and Plymouth harbors. Granted April 25, 1901.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, to maintain its poles on the easterly side of E Street, on the Commonwealth flats at South Boston. Granted May 6, 1901.

W. C. BRAMWELL, to remove gravel and material from the beach at Skull Head, in the town of Hull. Granted May 9, 1901.

ALBIN LEAL RICHARDS, to construct a temporary pile platform on Mystic River, in the city of Boston. Granted May 10, 1901.

BOSTON, PLYMOUTH & PROVINCETOWN STEAMBOAT COMPANY, to dump material dredged from Provincetown harbor at a point south of Long Point Light. Granted May 16, 1901.

MOSES WILLIAMS, to dredge in Cedar Pond Creek, in the town of Bourne. Granted May 16, 1901.

WILLIAM J. TILLEX, to remove gravel from the beach bordering on Quincy Bay at Hough's Neck, in the city of Quincy. Granted May 22, 1901.

SAMUEL T. HUMPHREY, to remove stones from the beach southerly of the causeway connecting Marblehead and Marblehead Neck. Granted May 29, 1901.

BAY STATE DREDGING COMPANY, to dump material dredged in Chelsea Creek on flats northerly of Orient Heights near Chain bridge. Granted June 14, 1901.

- ATLANTIC CLUB, to remove sand and gravel from the beach in front of upland belonging to said club at Point Allerton, in the town of Hull. Granted June 19, 1901.
- QUINCY YACHT CLUB, to dredge flats in Boston harbor at Hough's Neck, in the city of Quincy. Granted June 20, 1901.
- CHARLES H. SAWYER AND WILLIAM F. MACY, to dredge flats and a channel in Town River Bay, in the city of Quincy. Granted July 3, 1901.
- FANNY C. ADAMS, to dredge gravel from Half Moon Island in Quincy Bay, in the city of Quincy. Granted July 3, 1901.
- JOHN G. HALL & Co., to use a portion of the flats in the Reserved Channel adjacent to the Commonwealth flats, for the storage of logs; to erect, for temporary use, two dolphins in tide water; to erect an engine and derrick on land between the Reserved Channel and E Street. Granted July 3, 1901.
- JOHN S. BALLOU, to remove material from Ragged Island, in Boston harbor. Granted July 12, 1901.
- MARY A. HARVEY, to dredge a channel through flats in Quincy Bay at Hough's Neck, in the city of Quincy. Granted July 18, 1901.
- BAY STATE DREDGING COMPANY, to dredge material in Shirley Gut from the shoal extending out from Deer Island. Granted July 29, 1901.
- EASTERN DREDGING COMPANY, to dredge material from Mystic River, between Malden bridge and the Eastern Railroad bridge, also between Middlesex Avenue bridge and Foster's ship yard. Granted Aug. 1, 1901.
- EASTERN DREDGING COMPANY, to dredge gravel from Boston harbor near Lovell's Island. Granted Aug. 2, 1901.
- BAY STATE DREDGING COMPANY, to dredge material from Boston harbor near the south-westerly point of Deer Island. Granted Aug. 13, 1901.
- FRANK J. HANNON, to use a frontage of the sea wall on the northerly side of the Reserved Channel, on the Commonwealth flats at South Boston, for landing, storing and removing gravel. Granted Aug. 14, 1901.
- THOMAS MEANY, to use a frontage of the sea wall on the northerly side of the proposed Northern Avenue, easterly of the Commonwealth pier at South Boston, for landing, storing and removing sand and gravel. Granted Aug. 20, 1901.
- NANTASKET BEACH STEAMBOAT COMPANY, to remove sand from the berths and around Pemberton pier in Hull. Granted Oct. 14, 1901.

COLE BROTHERS, to dump material excavated for the foundation of the bridge over Apponagansett River in Dartmouth, at Bent's Ledge in New Bedford harbor. Granted Oct. 31, 1901.

ISAAC BLAIR & Co., to dump snow from Dover Street bridge into tide water in the city of Boston. Granted Nov. 25, 1901.

WORK OF THE UNITED STATES IN RIVERS AND HARBORS OF THE COMMONWEALTH.

The Board is indebted to Lieut.-Col. W. S. Stanton and Capt. Harry Taylor, Corps of Engineers, U. S. A., who are in charge of river and harbor improvements in eastern Massachusetts, and Maj. Geo. W. Goethals, Corps of Engineers, U. S. A., who is in charge of similar work in southern Massachusetts, for the following statements, which show the work accomplished in the rivers and harbors of this Commonwealth during the fiscal year ending June 30, 1901 :—

STATEMENT OF LIEUT.-COL. W. S. STANTON, CORPS OF ENGINEERS, U. S. A.

BOSTON, MASS., Dec. 13, 1901.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, Boston, Mass.

SIRS :— In accordance with your request of Dec. 2, 1901, I have the honor to furnish the following summary of work done by the United States during the fiscal year ending June 30, 1901, in the rivers and harbors of Massachusetts in my district.

The works of improvement under my charge on June 30, 1901, were :—

- | | |
|--|-------------------------------|
| 1. Lynn harbor. | 8. Town River. |
| 2. Boston harbor. | 9. Scituate harbor. |
| 3. Chelsea Creek. | 10. Duxbury harbor. |
| 4. Mystic River, below mouth of
Island End River. | 11. Plymouth harbor. |
| 5. Mystic and Malden rivers. | 12. Provincetown harbor. |
| 6. Charles River. | 13. Chatham harbor. |
| 7. Weymouth ("Fore" and
"Back") River. | 14. Examinations and surveys. |
| | 15. Wrecks. |

Operations upon these works during the last fiscal year have been as follows :—

Boston Harbor.

Works of preservation: repairs were made to the sea walls on Rainsford and Castle islands.

Works of improvement: 554,503.5 cubic yards of material were dredged, and 3,200 cubic yards of ledge were blasted and removed from the upper main ship channel; and 206,090 cubic yards of material were dredged from Broad Sound Channel.

Mystic and Malden Rivers.

No work was done in the section of Mystic River embraced in this improvement.

In Malden River, 13,576 cubic yards of material were removed during the fiscal year, in restoring the authorized depth of 12 feet at mean high water in the channel.

Mystic River, below the Mouth of Island End River.

From this section of Mystic River, 86,511 cubic yards of material were dredged, giving a depth of 25 feet at mean low water in the channel.

Scituate Harbor.

During the latter part of the fiscal year, 1,583.5 cubic yards of gravel were dredged from a shoal that had encroached upon the dredged channel near the wharves.

Plymouth Harbor.

Construction of the riprap dike on Long beach was continued, and 3,391.5 linear feet were built, containing 12,256.75 tons of stone.

Provincetown Harbor.

Five hundred and fifty-three linear feet of plank bulkhead were built for the preservation of the beach at Abel Hill dike.

Chatham Harbor.

No work was done, but at the close of the fiscal year a contract was in force for dredging a channel 6 feet deep at low water, and at the date of this statement the work has been completed.

Examinations and Surveys.

On Nov. 19, 1900, a report was submitted upon a survey of Lynn harbor, recommending the dredging of a channel 200 feet wide, 15 feet deep at mean low water, at an estimated cost of \$162,936.84. The report was published as House Document, No. 78, fifty-sixth Congress, second session.

On Nov. 28, 1900, a report was submitted upon a survey of Boston harbor, together with a project for deepening the main ship channel to 35 feet at mean low water from the Charles River and Chelsea bridges to the sea, through Broad Sound, at an estimated cost of \$10,612,710.46. The report was published as House Document, No. 119, fifty-sixth Congress, second session.

No work has been done during the fiscal year in Lynn harbor, Town, Weymouth, Chelsea and Charles rivers, or in removal of wrecks.

Very respectfully,

W. S. STANTON,
Lieutenant-Colonel, Corps of Engineers.

STATEMENT OF CAPT. HARRY TAYLOR, CORPS OF ENGINEERS,
U. S. A.

BOSTON, MASS., Dec. 17, 1901.

Board of Harbor and Land Commissioners, Boston, Mass.

GENTLEMEN:—In accordance with request contained in your letter of the 2d instant, I have the honor to furnish the following summary of the work done by the United States during the fiscal year ending June 30, 1901, in the rivers and harbors of Massachusetts under my charge:—

Newburyport Harbor.

No operations were in progress, other than making a survey of the bar at the entrance of the harbor. This survey shows that there has been some improvement in the depth of water over the bar, the controlling depth in 1901 being 12.6 feet at mean low water, as against 11 feet at mean low water in 1899, when the last previous survey was made. The channel had moved slightly to the north of its 1899 position, but retained about the same width that it had at that time.

Merrimac River.

The present approved project for the improvement of this river provides for a channel 150 feet wide and 7 feet deep at mean low water (ordinary low water stage of the river), from Newburyport to Haverhill. The first work under this project was begun in June, 1901, and at the close of the fiscal year the channel had been dredged 90 feet wide and full depth from a point just below Haverhill for a distance of 1,100 feet down river.

Powow River.

At the beginning of the fiscal year a channel 12 feet deep at mean high water and 45 feet wide had been dredged from the head of navigation at Amesbury for a distance of about 6,050 feet down

river. From this point to the mouth of the river the channel was 30 feet wide. During the past fiscal year the 45 foot width of channel has been extended nearly down to the highway bridge at Salisbury Point, where a section about 650 feet long still remains to be done. This section is at least 30 feet wide.

Essex River.

At the beginning of the fiscal year the channel had been dredged to its full projected depth, 60 feet wide, for a distance of 400 feet below the highway bridge in Essex, and at least 25 feet wide for the remainder of the distance to its lower end. During the fiscal year the project for the improvement of this river was completed, the improved channel now being 60 feet wide and at least 4 feet deep from the mouth of the river up to the highway bridge at Essex.

Harbor of Refuge, Sandy Bay, Cape Ann, Mass.

During the fiscal year operations have been continued in the construction of the substructure of the breakwater. During the year a total of 107,680 tons of rubblestone was placed in the breakwater. The substructure of the southern arm of the breakwater is now completed to mean low water, except for a distance of about 70 feet. A section of about 100 feet of substructure on the western arm was raised to mean low water during the year.

Gloucester Harbor.

At the beginning of the fiscal year a section of about 1,650 feet of the substructure of the breakwater had been completed to full proposed dimensions. The operations of the past fiscal year consisted in the construction of superstructure. The work commenced at the shore end of the breakwater at Eastern Point, and the superstructure was completed for a distance of 284 linear feet. A 3-inch steel spindle for the support of a light, which the Light-House Establishment proposed to maintain, was erected on the outer end of the substructure of the breakwater.

Examination and Survey.

Under the provisions of the emergency river and harbor act approved June 6, 1900, a preliminary examination and survey was made of Beverly harbor, with a view to obtaining a channel 200 feet wide and 18 feet deep at mean low water.

From a survey in 1899 it was found that this harbor possessed an available channel of 18 feet depth at mean low water to the wharves of the town, but the claim had been made recently that this channel had deteriorated materially. The present survey,

however, made in September, 1900, shows that, while no material shoaling has taken place, the width of the 18-foot channel is so narrow at certain points as to make it difficult to take heavy coal vessels through without touching on one side or the other. It was recommended that a limited amount of dredging be done, estimated to cost about \$10,000, in order to give a clear channel width of about 200 feet.

No work was in progress during the fiscal year on any of the other Massachusetts works in my charge.

Very respectfully,

HARRY TAYLOR,
Captain, Corps of Engineers.

STATEMENT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS,
U. S. A.

NEWPORT, R. I., Dec. 5, 1901.

Board of Harbor and Land Commissioners, Commonwealth of Massachusetts, State House, Boston, Mass.

GENTLEMEN:—In compliance with your request of Dec. 2, 1901, I forward herewith a summary of work done by the United States during the fiscal year ending June 30, 1901, in the rivers and harbors of Massachusetts.

Very respectfully,

GEO. W. GOETHALS,
Major, Corps of Engineers, U. S. A.

Abstract of the work of river and harbor improvement in the State of Massachusetts by the United States government, under the direction of Maj. Geo. W. Goethals, corps of engineers, U. S. A., for the fiscal year ending June 30, 1901:—

Hyannis Harbor.

No operations have been in progress during the past fiscal year.

This project contemplates the dredging of an area of 36 acres, protected by the breakwater to a depth of 15.5 feet. Of this area, about 26.6 acres have been dredged and two cuts 25 feet wide and 13 feet deep have been dredged in to the wharf of the New York, New Haven & Hartford Railroad Company.

Nantucket Harbor.

No operations have been in progress during the past fiscal year.

This project contemplates the construction of two jetties as training walls, one on each side of the harbor entrance, planned so as to allow the tidal currents to assist in scouring out and maintaining a good channel, and for the completion of the work by dredging where necessary to obtain a depth of from 12 to 15 feet

at low water in this channel. The west jetty has been built for a distance of 4,955 feet, and the east jetty 4,840 feet, from the initial points on shore. Portions of both jetties are still to be built up to their projected cross-sections. There is now a depth of 8 feet in the channel, which, before improvement, was limited to 6 feet.

Vineyard Haven.

No operations have been in progress during the past fiscal year.

An examination of the harbor, with a view to its further protection and improvement as a harbor of refuge, by a breakwater, or otherwise, was made in September, 1899, and report thereon submitted to Congress, and printed as House Document, No. 66, fifty-sixth Congress, first session; it was also printed at page 1289, Annual Report of the Chief of Engineers, for 1900. In this report it is recommended that Congress be asked to authorize a general investigation of the question of a harbor of refuge for Vineyard and Nantucket sounds, with a view to determining the best location for such a harbor.

Wood's Hole Channel.

No operations have been in progress during the past fiscal year.

The existing project provides for deepening the channel through the strait to 13 feet at mean low water, and widening the same to 300 feet. There is now a fairly good channel of one-half the projected width, 150 feet and 13 feet depth through the strait; but a few shoal spots west of the junction of the two branches of the channel need to be removed to complete the southern half of the channel.

New Bedford Harbor.

No operations have been in progress during the past fiscal year.

The existing projects provide for dredging an anchorage basin $\frac{1}{2}$ mile long, 600 feet wide and 18 feet deep at mean low tide, on the north side of the channel leading from Fairhaven to New Bedford; also for dredging a channel 250 feet wide and 18 feet deep from the anchorage basin through the new drawbridge between Fish and Pope's islands, to the deep water above. About .6 of the anchorage basin has been dredged; also the entire channel leading through the drawbridge; but, owing to the very soft character of the material through which the latter was dredged, the full depth has not been maintained throughout its width.

Eighteen feet of water may now be carried from the deep water of Buzzards Bay through the drawbridge.

Taunton River.

No operations were in progress during the past fiscal year.

The existing project contemplates dredging a channel so that it shall have a width of 100 feet and depth of 12 feet from the mouth of the river up to Berkley bridge; thence 12 feet depth and 80 feet width up to Briggs shoal; thence 11 feet depth with the same width up to the ship yard; thence 11 feet depth with 60 feet width up to Weir bridge, the depths all being referred to mean high water. This project is essentially completed, but there are a few points at which the channel requires widening.

Fall River.

No operations were in progress during the past fiscal year.

The existing project provides for a channel 300 feet wide and 25 feet deep at mean low water, along the city front between the deep water just below the Old Colony wharf and the deep water at the upper end of the harbor. The lower reach of this channel, extending from its lower end up to the Staples Coal Company's wharf, and comprising about one-half of the projected work, has been completed.

Removal of Wrecks.

During the fiscal year, the following wrecks were removed, so as no longer to form obstructions to navigation.

Schooners "Laura Robinson" and "David Siner" from the vicinity of Pollock Rip Light Ship, and the British steamer "Ardanhu" from Vineyard Sound near Robinson's Hole.

HARBOR COMPENSATION FUND.

There was paid into the treasury of the Commonwealth during the year, under sections 14 and 16 of chapter 19, Public Statutes, and chapter 146, Acts of 1897, in payment for tide water displaced by work done under licenses granted by the Board, and for rights and privileges granted in tide waters and great ponds, the sum of \$29,475.11, which was credited to the harbor compensation fund for Boston harbor. The amount in this fund on Nov. 30, 1901, was \$357,864.66; the income from this fund on the same date was \$19,891.47.

COMMONWEALTH'S FLATS IMPROVEMENT FUND.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1900, was \$622,830.65. To this has been added during the year \$22,781.56 from the income of the fund and \$30,282.55 from sales and rents of lands and other sources, making a total of \$675,894.76. Of this sum, there has been expended during the year \$70,598.51, leaving a balance on Nov. 30, 1901, of \$605,296.25.

TAUNTON RIVER AND BOSTON HARBOR CANAL.

Chapter 104 of the Resolves of 1901 directed the Board to make surveys and estimates as to the probable cost of constructing a ship canal from Narragansett Bay through Taunton, Brockton and Weymouth to Boston harbor, by way of Weymouth Fore River, and to report thereon to the General Court now sitting.

The depth and width of the proposed canal were apparently left to the judgment of the Board. A uniform depth of 25 feet and a width of 130 feet on the bottom, with side slopes of 1 on 2 in earth, and 180 feet with vertical sides where rock is encountered, have been fixed for the dimensions of the trunk of the canal.

A general location was determined from a study of the topographical maps, base lines were run, and a topographic and hydrographic survey was made for a distance of not less than 500 feet on either side for the entire distance from Weymouth Fore River to Slade's Ferry bridge near the mouth of Taunton River, with levels on the same and on cross-sections 500 feet apart. Other necessary levels were run and tidal observations made. The plane of reference of the survey was established at 1.5 feet below the mean sea level at Boston.

The results of these surveys were plotted on large scale plans, and contours drawn, showing every difference of 2 feet in elevation over the area surveyed. After a careful study of the information accumulated, a route was finally adopted.

The total length of the canal upon which the estimates

are based between the ends of the approach structures of the tidal locks is 31.79 miles, of which 7.24 miles are on curves, the radii varying from 5,000 to 10,000 feet, and 2.22 miles of shorter radii, none, however, less than 2,000 feet. In fixing the line, due regard was had to economical construction.

Provision is made for 14 locks, 6 between Boston harbor and the summit level and 8 between there and the dam in Taunton River, with lifts varying from 7 to 25 feet. On the basis of 20 lockages a day, 33,000,000 cubic feet of water will be required for the daily operation of the locks.

A careful examination of the water supply and of the different methods of providing the necessary amount of water led to the adoption of a pumping system, as being the most advisable. The water surface of the summit level lies between Brockton and Randolph. The summit level is 16,000 feet long, at an elevation of 130 feet.

Two masonry dams are planned at the two ends of the canal, across Taunton River and Weymouth Fore River, respectively, opposite the tidal locks, to maintain the water in the rivers at high tide level.

The proposed line of the canal crosses the railroad at eleven places; it is proposed to avoid five of these by diverting the location of the tracks, and two of the others are drawbridges at the present time. It also crosses forty-six highways, of which a number are avoided by a rearrangement in such manner that the distance to be travelled will not be materially increased. Twenty drawbridges will cross the canal in most of which a clear width of 100 feet is provided for the passage of vessels.

Wherever the water level of the canal rises above the adjacent country, the side embankments are planned with puddle walls of clay; but where it runs through earth, a protection of broken stone, extending from 5 feet above to 5 feet below the water level, will be provided. Turning basins are proposed at Taunton, Brockton and Holbrook, approximately 600 feet square.

The cost of a sufficient right of way has been estimated. All estimates are based on unit prices, carefully considered;

and yet allowance must be made, owing to the brief time permitted for the examination of so large an undertaking. The total cost is estimated at \$57,618,358.

A full report by the engineer * of the Board, together with plans of location and profile, may be found in the Appendix.

The foregoing report is respectfully submitted.

WOODWARD EMERY,
CHARLES C. DOTEN,
GEORGE E. SMITH,
Commissioners.

DEC. 1, 1901.

* See Appendix D.

APPENDIX.



APPENDIX.

[A.]

[See page 4 of this report, *ante*.]

CONTRACTS.

The contracts entered into during the year are as follows:—

1901.

Feb. 14.	With the Bay State Dredging Company, for dredging in Fort Point Channel, Boston harbor, between Congress Street bridge and Rowe's wharf, for the sum of 25 cents per cubic yard of material, measured in scows, — amounting to	\$14,317 25
March 7.	With William J. Lawler, for building a sea wall on the Commonwealth flats, at South Boston, for the sum of \$56.49 for each lineal foot of completed sea wall, — estimated to amount to	76,300 00
April 20.	With the Harries & Letteney Company, for dredging in Plymouth harbor, near Long beach, for the sum of 28½ cents per cubic yard of material, measured in scows, — amounting to	797 72
May 16.	With the Bay State Dredging Company, for dredging in Shirley Gut, Boston harbor, for the sum of \$1,000, and in addition the sum of 35 cents for each cubic yard of material, measured in place, dredged and deposited on the Commonwealth pier at South Boston, — amounting to	5,429 60
May 31.	With Thomas Meany, for moving and grading gravel on the Commonwealth pier, at South Boston, for the sum of 30 cents for each cubic yard of material moved, measured in the fill, — amounting to	3,796 80
July 16.	With George H. Cavanagh, for dredging a portion of Lake Anthony, at Cottage City, and setting buoys, — amounting to	2,500 00
July 30.	With Thomas H. Kiely, for furnishing riprap stone on the bank of the Connecticut River, at Hadley, for the sum of \$1.67 for each cubic yard of stone delivered, — amounting to	5,888 09

1901.

Sept. 6.	With the Eastern Dredging Company, for dredging a portion of the dock on the westerly side of the Commonwealth pier, at South Boston, for the sum of $22\frac{1}{2}$ cents for each cubic yard of material, measured in scows,—estimated to amount to	\$15,500 00
Sept. 17.	With Eugene S. Belden, for strengthening the jetties built under the direction of the Board, at Osterville, for the sum of \$2.47 for each ton of stone placed in the work,—amounting to	2,964 00
Nov. 14.	With Augustus Bellevue & Co., for building jetties and dredging channel at the mouth of Bass River, in Dennis and Yarmouth,—estimated to amount to	20,307 60
Nov. 22.	With the New England Dredging Company, for dredging in Boston harbor, near Union wharf, for the sum of $32\frac{1}{8}$ cents for each cubic yard of material measured in scows,—amounting to	4,217 53
Total amount,		<hr/> \$152,018 59

[B.]

[See page 26 of this report, *ante*.]REPORT OF ENGINEER IN CHARGE OF CONNECTICUT
RIVER WORK.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., Chairman.

GENTLEMEN:—Following the instructions and authority given me by your vote of July 11, 1901, in carrying out the provisions of chapter 94 of the Resolves of 1901, relating to the further protection of the easterly bank of the Connecticut River in the town of Hadley, I have completed the season's work therein contemplated, and submit the following report thereon:—

The section of river bank protected by this year's operations extends from the northerly end of the section treated in 1900, up the river to Coleman's Brook, so called, a distance of 1,455 feet.

The plan adopted last year, at the suggestion of your engineer, Mr. Hodgdon, of a continuous matting of poles and willows, interwoven for the submerged part of the work, has been followed this year, with very satisfactory results. A description in detail of methods employed seems unnecessary here, as it would simply be a repetition of what has already been given in former reports.

The contract for stone for riprapping, made by you with Thomas H. Kiely of Northampton, has been faithfully carried out on his part, the stone having been delivered promptly, and of the required dimensions.

The quantity delivered was 3,525.8 cubic yards, at a cost of \$5,888.09.

Active operations were commenced July 15, and the work completed November 5.

The area covered by mats and riprapping is 19,989 square yards, and the total cost has been \$10,660.78, which is 53½ cents per square yard. The above total includes surveys, plan and estimate for a proposed dike below the highway bridge over the river between Hadley and Northampton.

The protective work has been carried into the ravine of Coleman's Brook a sufficient distance to prevent any damage to the banks by the action of waves or currents of the river. Proper

connection has also been made at the lower end of this season's work with that completed in 1900.

With but one or two exceptions, local help has been employed on the work, under the immediate supervision of Roswell S. Gaylord, whose recognized ability and good judgment have contributed largely to the economical prosecution of the work.

The scows and lumber used on the work are piled up and roofed over on land of C. P. Wood, at the head of Front Street. The tools, tool box, ropes, etc., are housed in R. S. Gaylord's barn.

You will undoubtedly direct that young willows be set in this season's work at a suitable time next spring to complete the work, as has been done in years past.

The protective works built from year to year under your direction are now completed from the head of Front Street, in Hadley, around the "high banks," so called, to Coleman's Brook, a distance of 5,100 feet, and afford a continuous line of protection for the main part of the town from further encroachments of the river between the points named. Above and below these points there is no pronounced erosion of the banks, and I am confident that no further expenditures will be necessary for years to come on this part of the river.

The inhabitants of the town of Hadley fully appreciate the work that has been done for them, under your supervision, for the protection of the business part of their town, and the danger, so long manifest, by the yearly encroachments of the river at the head of their principal streets, it is believed, has been successfully met and overcome.

A serious break occurred in the river bank, below the highway bridge above referred to, during the high water of last spring. In company with your Mr. Hodgdon, this matter was examined, together with its probable effect on the adjacent lands, and a dike was suggested, extending from the highway to the river bank, as a preventive of further damage at this place. Surveys have been made for this dike, and a plan and estimate of the cost were submitted to you July 27, 1901. If it is decided to build this dike another year, the town of Hadley will undoubtedly take the necessary steps to secure a title to the land where it is proposed to locate it, and the material with which to build it.

Respectfully submitted,

E. C. DAVIS,
Engineer and Superintendent.

[C.]

[See page 82 of this report, *ante*.]REPORT OF THE SUPERINTENDENT, PROVINCE
LANDS.

PROVINCETOWN, MASS., Nov. 30, 1901.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—As Superintendent of the Province Lands, I respectfully submit the following report for the year ending Nov. 30, 1901:—

The first work of the season, about the middle of March, was the construction of a road, beginning at the point to which it had been built up to the close of the season of 1900, and continuing the same to its terminus at the outer beach of the reservation, a distance of about 1,900 feet, at a cost of \$745 or about 40 cents per running foot, the increased cost over that of last year being on account of the greater distance to cart the material.

This road makes a very acceptable driveway across the reservation, a distance of about 2 miles, or, by connecting with the town road from the harbor front to the outer beach, about 3 miles. It is very convenient for the people of Provincetown and others who wish to go to and from the outer beach and life-saving stations, and has been extensively used by many summer visitors. It has remained in remarkably good condition for a sod road, considering the amount of travel which has passed over it. The first section of the road, built in the spring of 1894, is still in good condition, and has required but little work and attention.

The same method of checking the drifting of the sands and of reclaiming the lands has been followed; namely, the transplanting of beach grass for a sand binder, and the planting of trees, shrubs and seeds of various kinds, principally pines and bayberry (*Myrica cerifera*).

The transplanting of beach grass began about the middle of May, and continued, as weather permitted, until June 5, when this work was suspended. It was resumed about the middle of September, and continued until November 20, the total area covered during the season being about 20 acres. Owing to the excellent results obtained from the use of bayberry on ground already

covered, it was considered advisable to introduce this shrub simultaneously with the grass; and, although a smaller territory was covered, permanent results were obtained.

As in past seasons, a large number of young pines taken from the woods and bogs have been transplanted along the foot of the slopes, and pine seeds planted on the flat grounds between the ranges of sand dunes.

The weather conditions during the entire season have been very favorable, and, as a consequence, a very marked improvement in the work of the past and present seasons is observable, the grass-plants, trees and shrubs having made a vigorous growth.

Notwithstanding the fact that during the last two months there have been some very strong winds, yet the planted territory remains intact, and no movement of sand from these sections is observable.

About 170 acres of the exposed slopes have been covered since the spring of 1895. An additional area of about 115 acres should have immediate attention, and when this is covered, a comparatively small outlay only will be required to keep the same intact.

Respectfully submitted,

JAMES A. SMALL,
Superintendent of the Province Lands.

[D.]

[See page 111 of this report, *ante*.]REPORT OF ENGINEER ON TAUNTON RIVER AND
BOSTON HARBOR CANAL.

BOSTON, Jan. 20, 1902.

*To the Board of Harbor and Land Commissioners, State House, Boston,
Mass.*

GENTLEMEN : — In accordance with your instructions, I have had surveys and estimates made as to the probable cost of constructing a ship canal from Narragansett Bay to Boston harbor through Taunton River and Weymouth Fore River, under chapter 104 of the Resolves of 1901 : —

Resolved, That the board of harbor and land commissioners is hereby directed to make or cause to be made surveys and estimates as to the probable cost of constructing a ship canal beginning at some convenient point on Narragansett bay and Taunton river, harbor or estuary thereof, and extending across the state of Massachusetts through the cities of Taunton and Brockton and the town of Weymouth to Boston harbor by way of Weymouth Fore river. For this purpose the board may employ an engineer or engineers and other assistants, and may expend a sum not exceeding ten thousand dollars. The board shall report to the general court not later than the fifteenth day of January in the year nineteen hundred and two. Whatever amount is expended by the board for the purpose authorized by this resolve shall, in the event of the granting of any charter or franchise for the construction of a canal between the points above specified, be repaid to the Commonwealth by the grantee or grantees of such charter or franchise. [*Approved June 13, 1901.*]

The statute simply provides for the surveys and estimates for a ship canal, without in any way indicating the size of ships to be provided for ; but it limits the location by providing that it shall pass through the cities of Taunton and Brockton and through the town of Weymouth.

The plan adopted for the investigation is as follows : First, to determine the general character and dimensions of the canal, and where it could probably be located. Then the field surveys were undertaken, under the general supervision of Mr. Henry B. Wood, with Mr. Eugene E. Pierce, Mr. A. D. Butterfield and Mr. L. H. Bateman in immediate charge of the different survey parties ; and

in the office Mr. John R. Burke, Mr. W. W. Marrs, Mr. T. W. Bailey and Mr. E. W. Hadcock were employed in the preparation of the plans and estimates, the field note books being sent to the office, and the plans prepared as soon as the books could be spared from the field work.

Mr. F. W. Dean, Mr. S. E. Tinkham, Mr. Henry D. Woods and Mr. E. L. Brown have made estimates and examinations as to pumping, machinery, bridges, mechanical lift locks, and the nature of the soil through which the canal is to be constructed.

Upon the completion of the field surveys, Mr. D. J. Howell, who had been engaged as assistant engineer on the surveys and in preparing the report of the United States Board of Engineers on deep water ways from the Great Lakes to the Atlantic coast, and as consulting engineer in charge of the surveys and estimates for a barge canal from the Great Lakes to the Hudson River, under the direction of Hon. Edward A. Bond, State engineer and surveyor of New York, was engaged to assist in the preparation of the plans and estimates. Mr. Howell brought to the work a great fund of information collected during his work on the New York investigations, and to this is due much of the completeness of this report; as, owing to the limited time after the completion of the field work, it would otherwise have been impossible, with the small appropriation available, to prepare the necessary plans and estimates, — and, as it is, much is lacking, owing to our inability, through lack of means, to make borings and do other work necessary to obtain a complete knowledge of the facts.

My first endeavor was to determine the size of the canal which was required, and at my request you addressed a letter to Mr. Parker C. Chandler, who had been prominent in advocating the passage of the resolve through the Legislature, asking him for any information he had bearing on the subject under investigation, and also as to the size of the canal desired by the petitioners. In his reply he stated that considerable information might be obtained from documents in the State Library, and referred to the report of the committee of the Legislature who explored a line for a canal over this route, and made a report on the same in February, 1808. He also stated that reports had been made by officers of the general government on the same subject; and a copy of a report made by the Board of Internal Improvement and transmitted to Congress by the Secretary of War on Feb. 16, 1825, on the proposed canal from Barnstable Bay to Buzzards Bay, and also on a general examination of the route from Narragansett Bay to Boston harbor, has been found. This report stated that a general and thorough survey of this route appeared to be wanting.

A copy of a portion of a plan made by the United States Topographical Engineers in 1833, from a detailed survey of the portion of the route from Boston harbor to Brockton, has also been found; but the report of the engineers on this survey we have not been able to find up to the present time, although search has been made for it in the State Library and at the office of the Chief of Engineers at the War Department at Washington.

In regard to the size of the canal, Mr. Chandler stated that it was the intention of the petitioners to have that matter left open, so that the commissioners would study the matter and decide as to the size of the canal which would be required by modern vessels. He also stated that the general government had comprehensive plans for a scheme of inland navigation stretching along the coast line from Boston harbor to Florida, and the line from Boston harbor to Narragansett Bay was one link in this scheme. He also called attention to the various forms of mechanical lifts which had been designed and in some cases put in successful operation to take the place of the ordinary canal lock; and also to the modern machinery which had been designed for the construction of canals, thereby greatly reducing their cost, and also stated that the project for this canal would be called to the attention of the next Congress. He promised at the same time to forward several books, documents and maps which would be of service, but he was unable to do so.

As his letter did not give information as to the size of the canal required, in seeking other sources of information as to this question, letters were addressed to the Secretary of the Navy and the Secretary of War, asking what plans the government had in relation to water ways along the Atlantic coast, and especially between Narragansett Bay and Boston harbor, and as to the size of any proposed water ways in this location, also for such opinions as might have been expressed by any of the officers of the Engineer Corps or of the Navy as to the dimensions which such a water way should have.

The Secretary of the Navy in replying simply stated the dimensions which had been adopted in 1884 for a projected canal from Barnstable Bay to Buzzards Bay, and the dimensions of the Kaiser Wilhelm Canal and the Suez Canal, stating that this was all the information on file in the department which it was deemed would be of value to us.

The letter to the Secretary of War was referred to the Chief of Engineers, and in his reply he stated that no plan had been formed by the federal government for a system of internal water ways along the coast from Maine to Florida, but that a number of inland

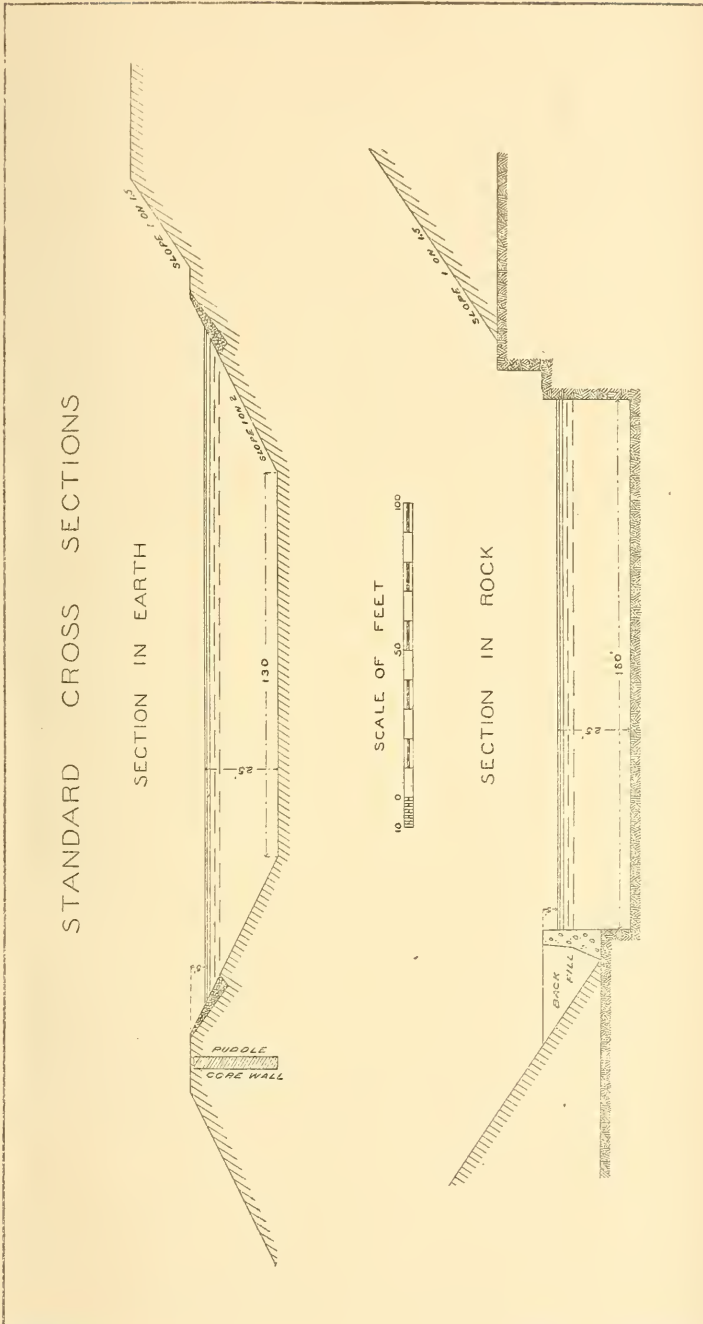
routes are being improved, under appropriations made by Congress, between Delaware Bay and Florida, and that surveys for others within the same limits had been made, and forwarded copies of the latest reports on these works. On examination of these documents, it was found that all the water ways now under improvement are for light-draft vessels, and the only information as to such a ship canal as is proposed in the case under consideration was in a report made in 1894 on a survey for the Chesapeake and Delaware Canal, which was to connect Baltimore harbor with deep water at the mouth of the Delaware River. This was to be a canal 100 feet wide on the bottom and 26 feet deep at low water.

In view of the fact that the statute incorporating the Boston, Cape Cod & New York Canal Company, in 1899, fixed the dimensions of this canal as depth 25 feet and bottom width not less than 100 feet, it was decided that it would not be wise to adopt any smaller dimensions. A depth of 25 feet is sufficient to float the vessels engaged in the coastwise traffic, and, with the width of 60 feet in the locks, any of the naval vessels, except battle ships, could pass through.

In order that the canal shall have sufficient cross-section to enable vessels to pass through at a fair rate of speed, the width has been made 130 feet on the bottom, with the side slopes 1 on 2, for all sections where it is expected earth will be found; but where rock is encountered, the section will be 180 feet wide, with vertical sides. This gives cross-sections about four times greater than the midship section of the largest vessel which could safely navigate a canal of this depth, and is about the same as that of the Manchester Ship Canal. In this width the ordinary coastwise steamers could safely pass in any place with only a slight reduction in their normal speed through the canal.

Having fixed the dimensions of the trunk of the canal, search was made for an approximate location, using the plans of the State topographical map. A study was made on this map of the different lines which had been suggested at different times by various parties, among them the lines shown on the lithograph plan presented to the Legislature by Mr. Chandler, and the two lines surveyed by the United States Topographical Engineers between 1821 and 1833.

All the lines surveyed along this general location except the present scheme have been for small barge canals, and it was found that the general course followed by these would be the best for the proposed ship canal. In general, the line selected starts in Weymouth Fore River, a short distance above the bridge at Quincy Point; thence follows the valley of the river to Weymouth land-



ing; thence up the valley of Smelt Brook a short distance, crossing the south shore branch of the Old Colony Railroad at Weymouth landing and the main street of the town close to the East Braintree boundary line; thence continuing up the brook and through the divide into the valley of the Monatiquot River; thence following up this valley, crossing the Plymouth & Whitman branch of the Old Colony Railroad and the present main line of the Old Colony Railroad just south of the South Braintree station; thence across Dyer hill, following along the Cochato meadows and crossing the Taunton branch railroad opposite Mayflower Park, and the line of the Cape Cod branch railroad about 3,000 feet north of Holbrook station; thence keeping a short distance east of the railroad and passing through the divide near Avon station into the valley of Trout Brook, and along the valley of this brook and Salisbury Plain River through the city of Brockton, crossing the Middleborough section of the Plymouth division of the New York, New Haven & Hartford Railroad a little south of Campello station; thence through the divide between the valley of the Salisbury Plain River and Town River, crossing the West Bridgewater branch of the Old Colony Railroad; thence along the valley of Town River, passing through Hockanock swamp, Nippinicket Pond, and the divide into the valley of the next stream south, a tributary of the Taunton River, which runs through the village of Raynham; thence down the valley of this stream and the Taunton River to Weir village in the city of Taunton, and thence following the Taunton River to its mouth in Mount Hope Bay.

The general location having been determined from the study of the maps, two parties were organized for making a detailed survey of the location. Base lines were run and the topography and hydrography surveyed the whole distance from Weymouth Fore River to Slade's Ferry bridge near the mouth of Taunton River. In general, the base line followed the line of the proposed canal, and the topography was surveyed for a distance of not less than 500 feet on either side of the line. The angles in the base line were connected with the triangulation stations of the town boundary survey, and in this way the whole work was checked and errors avoided. At a number of places where there appeared to be a choice as to the best location, the surveys extended over a considerably greater width.

Levels were run the whole length of the base lines, and on cross-sections every 500 feet; these levels furnished points from which the topographic parties could check their work. In addition, a line of precise levels was run from Somerset to Weymouth landing, following the line of the railroad and highways, connect-

ing at frequent intervals with the line of levels run along the base lines. At the same time, tidal observations were made at both ends of the canal, and compared with the benches of the United States Coast Survey. From these levels, adopting the mean sea level calculated from the observations of the Coast Survey at Boston, it was found that the plane of reference of the survey was 1.5 feet below mean sea level at Boston, while the mean water level at Somerset was a few tenths of a foot higher than that at Boston, due probably to its distance up the river from the sea.

The difference in elevation of the various benches, as determined by the line of precise levels and the line run over the base line, did not vary at any point more than .3 of a foot. Many bench marks were established along the line of these levels, which will probably be found useful in future work. The results of these surveys have been plotted on a series of 24 sheets, each 30 by 52 inches, on a scale of 1 to 2,000, and one sheet about the same size on the scale of 1 to 5,000. On the large scale sheets contours were drawn showing every 2 feet difference of elevation, and on the sheets thus prepared the centre line of the proposed canal was located.

A diligent inquiry was made for information as to borings which had been made for any purpose along the line of the proposed canal, and as to the character of the material through which the wells in the vicinity had been dug or driven, also the same information in relation to other excavations. The outcrop of all ledges along the line of the survey were located by the survey parties, so that, although unable to make any borings of our own, sufficient information was obtained to give a very fair idea of the character of material to be excavated, and on what material the various structures would probably be founded.

Information furnished by the city engineers of Brockton and Taunton and by Mr. Edward Parrish of the United States Engineer Office at Newport was of much value in this part of the investigation, and other parts of the work were very much facilitated by using the plans and data furnished by them and others.

South of Brockton, in addition to the route finally adopted, surveys were made over a route crossing the divide to the west of Campello station, and following down the valley of Black Betty and West Meadow brooks, rejoining the original route at Skim-milk bridge, a short distance north of Nippinicket Pond. This route would have avoided the necessity of going directly through the village of West Bridgewater, but after considering the two, the easterly one was adopted as preferable. At the northern end an alternative route from South Braintree to the Weymouth Fore River was to follow the valley of the Monatiquot River from South

Braintree to Braintree; thence across the country to a point in Weymouth Fore River just south of the new works of the Fore River Ship and Engine Company. On the maps this appeared to be quite feasible, but, as it did not enter the town of Weymouth, as is required by the statute, it was not surveyed.

South of Taunton the line follows the general location of the Taunton River; but, owing to the sharp curves in the river, it was found necessary to cut through the bends in many places in order to get such an alignment as would enable large steamers and barges to safely navigate the new channel. It is planned to establish tidal locks at each end, the one in the Taunton River to be located just north of the village of Dighton, and the one at Weymouth Fore River on the westerly bank of the river, about opposite the northerly end of White's Neck. Between the tidal locks are 12 other locks, with lifts varying from 16 to 25 feet.

Alignment.

The total length of canal on which the estimates are based between the ends of the approach structures of the tidal locks is 31.79 miles; of this, 22.33 miles is straight, and the balance, 9.46 miles, on curves of radii varying from 2,000 to 10,000 feet, only 2.22 miles having radii of less than 5,000 feet.

On all curves of less than 10,000 feet radii the width of the canal was increased by an amount determined by the following formula: $60 - .005 \times \text{radius}$, all dimensions in feet, the additional width being added one-half on each side at the middle of the curve, and tapered to nothing at the tangent points.

The canal line was located where, from all the information obtained, it appeared that the canal could be most economically constructed within the limits prescribed by the resolve. Further investigations and borings to determine the character of the material through which it is to be built and on which the various structures are to be founded will undoubtedly show the advisability of some changes in the location of the canal and its various structures; but any changes which are liable to be made will not, in all probability, materially alter the total cost.

Northern Approach.

At the northern end of the canal deep water is found at the mouth of Weymouth Fore River, about $2\frac{1}{2}$ miles below the bridge at Quincy Point. This channel is the approach to the works of the Fore River Ship and Engine Company; and in making the estimates it has been assumed that it would be enlarged and deepened by the general government as an approach to these

works, and the cost of doing this work has not been included in the estimates for the canal.

Between the bridge and the tidal lock (a distance of about 1 mile) the estimates are for a channel substantially 500 feet wide and 25 feet deep at mean low water, the width being much greater than at any other portion of the canal, owing to the very sharp curves which it is necessary to introduce.

The most natural location for the purposes of navigation would have been to excavate a channel across the neck of land known as Old Spain, which would have given practically a straight channel from the mouth of the canal into the lower part of Weymouth Fore River. No estimates have been made for this, as it did not seem that the increased facilities for navigation would be sufficient to justify the greatly increased cost.

The plans of the general government for the improvement of the Weymouth Fore River are simply to obtain a channel from a point about opposite the proposed entrance lock of the canal up to the head of navigation, not less than 6 feet deep at mean low water, and of a width varying from 100 feet to 50 feet. This has been substantially completed, and no plans have been adopted for any further improvement.

Southern Approach.

At the southern end of the canal deep water is found in Mount Hope Bay just below the point where the line between Massachusetts and Rhode Island crosses it. Above this in Fall River harbor and between Fall River and Somerset there are long sections where the channel is more than 25 feet deep for a width of not less than 300 feet, but there are bars crossing it at a number of places. The plans of the general government contemplate the excavation of a channel 25 feet deep at mean low water and 300 feet wide through these bars up through Fall River harbor to Slade's Ferry bridge. From this point nearly up to Somerset, a distance of 3 miles, the channel is continuous, and of sufficient width and depth; from thence up to the entrance lock, a distance of 4.5 miles, the channel will have to be excavated to a depth of 25 feet at mean low water with a width of 300 feet. The plans of the general government at present contemplate the deepening and widening of the channel so as to secure a depth of at least 12 feet at high water, with a width of 100 feet up to Berkley bridge; thence the same depth and 80 feet wide up to Briggs shoal; thence 11 feet in depth with the same width up to the ship yard; thence 11 feet depth with a width of 60 feet up to Weir bridge at Taunton. These plans have been practically completed. The work remaining to be done

consists of the removal of a small amount of ledge and some dredging below Berkley bridge. In making the estimates it has been assumed that the general government will carry out its plans and excavate the channel up to Slade's Ferry bridge, and the estimates include only the work of dredging the channel from the deep water below Somerset to the tidal lock.

Style of Lock.

In a canal of this size the question of the water supply is a very serious one, especially in a flat country, where the drainage areas tributary to the canal, especially those above the elevation of the summit level, are not large.

The ordinary form of lock to accommodate vessels of the size which may be expected to use a canal in this location requires the discharge of a very large volume of water from the upper level into the lower level whenever a vessel passes from one to the other. This loss from the upper level must be supplied from some source. In order to avoid the necessity for such a great loss of water, various mechanical devices have been designed. Many of these have been used on barge canals, but I know of no case where they have been used on a canal as large as the one now under consideration. In addition to the saving of water, these mechanical appliances are designed to be used for much higher lifts than the ordinary lock, so that each one will take the place of a number of the ordinary type, with a corresponding decrease in the length of time required for a vessel to pass from one level to another.

These mechanical appliances are of different types. The earliest, known as chain lifts, consisted of a wooden or metal box with gates at each end, filled with water, and large enough to contain the largest boat using the canal. To this were attached a number of chains which passed up over pulleys mounted on framework, the other ends of the chains being connected with counterweights sufficient to counterbalance the weight of the box full of water. After the boat was placed in the lock and the gates closed, sufficient water was either drawn into or from the box to make it heavier or lighter than the counterweight, so that it would either drop or rise, as required, to the other level of the canal.

Next come the various kinds of hydraulic lifts. These also consist of boxes or tanks sufficient in size to contain enough water to float vessels using the canal, and they are raised or lowered by hydraulic rams, which are either placed directly under the box or alongside it; in the latter case, the ends of the rams carry large pulleys over which pass chains or wire ropes, one end of which is

attached to the press of the ram, the other to the side of the lock. These are ordinarily constructed in pairs.

The third form is the floating lift, which consists of one or more tight tanks floating in a deep pit, and supporting above them on trestle work the box of the lock. The floats being submerged, it requires the application of a small amount of power to raise or lower the lock.

The fourth form is the pneumatic lock, which consists of an inverted tank in a pit filled with water. On the top of this tank is the ordinary lock box, with gates at the ends, filled with water. These locks are designed to be used in pairs, the two inverted tanks being connected by large pipes, and the air passing from one to the other as the locks are raised and lowered, one rising as the other lowers.

The first three styles have been used in various forms in this and European countries, but so far as I have been able to learn, the pneumatic lifts have not been in use as yet.

Mr. Woods's notes, describing the various lifts which have been designed or built, are hereto annexed.* From the results of this study, and as the heights of the lifts in the canal under consideration are well within the range of work which has already been constructed, and as the construction of mechanical lifts of this size would be somewhat of an experiment, none having actually been constructed, it has been decided that for the purpose of this estimate it will be better to provide for using the ordinary style of lock.

Water Supply.

Having decided to base the estimates on the ordinary style of lock, the question arises as to where the necessary water supply can be obtained.

The number of vessels arriving at Boston from southern ports in 1900, as stated in the annual report of the Boston Chamber of Commerce, is as follows: tugs, 1,235; steamers, 1,083; barges, 2,817; total, 5,135, — an average of about 14 per day. If these all came and returned through the canal and passed through the locks singly, it would make 28 lockages per day; but, as the arrivals are not regular, and the locks being large a number can pass through at one lockage, it has been deemed best to assume 20 lockages per day of the full-sized locks as a basis on which to calculate the supply of water required. All of the locks north of the summit level of the canal except the tidal lock have lifts of practically 25 feet each. The locks south of the summit

* Not printed.

level vary from 16 feet to 21 feet lift, and, on the basis of 20 lockages each day, it will require 30,000,000 cubic feet of water daily to operate the locks.

As the canal is located so as to be generally below the ground-water level of the surrounding country, the loss of water from seepage would probably not be large. To provide for this and for the leakage through the lock gates and culverts, it is estimated that 3,000,000 cubic feet per day will be required, making the total amount of water required 33,000,000 cubic feet per day.

There is no drainage area near the location of the canal which will supply such a large quantity of water at an elevation above the summit level, and such small portions as are at the necessary elevation are largely used at the present time in supplying the population in their vicinity with water for domestic use. The stream which most nearly meets the required conditions is the Blackstone River. This has a drainage area above the dam at Millville in Blackstone of 258 square miles; and, if all the water from this drainage area can be intercepted and stored, it would nearly supply the demands of the canal, on the basis of 20 lockages per day of the full-sized locks. The river at Millville is about 70 feet above the summit level of the canal, — a sufficient elevation to enable the water to be diverted into it.

An aqueduct capable of conducting the water would be about 30 miles long, and would have to be built very largely in tunnel. It would be very nearly straight, and would pass along the southerly side and near the summit of the main divide, separating the streams which flow northerly into Boston Bay and southerly into Narragansett Bay, crossing nearly all the valleys which it intersects substantially at right angles.

Owing to the configuration of the country, it would be difficult and expensive to construct reservoirs to store all the water on this water-shed. For this reason, another method of furnishing the water supply was investigated, viz., to pump it from the Weymouth Fore River at the northern end of the canal up into the summit level. For this purpose four sets of pumps would be required: one set to pump from the river directly into the level above lock No. 3; another set to pump from the level below lock No. 4 into the level above the same lock; the third to pump the water from the level below lock No. 5 to the level above the same lock; and the fourth to pump from the level below lock No. 6 into the summit level.

Owing to the large quantity of water to be raised, the estimates have been made for furnishing a steam plant at each pumping station, as being cheaper and more reliable than generating the power at one station and distributing it by electricity. The first cost of

the pumping plant is very small compared with the cost of furnishing the water from the Blackstone River, but the operating expenses are very large. Upon comparing the two estimates on the basis of capitalizing the operating expenses of both systems, the pumping system was found to be the least expensive. Moreover, the pumping system would be more compact, and there would be much less disturbance of local conditions.

One serious objection to the use of the water from the Blackstone River is its polluted condition, it being, according to the reports of the State Board of Health, the most seriously polluted stream in the Commonwealth.

Locks.

The highest point on the line of the canal is about 160 feet above mean sea level, and is located just north of the city of Brockton, in Holbrook and Avon; and the water surface of the summit level of the canal has been fixed at elevation 130. The ascent from Weymouth Fore River to the summit is quite regular, and much steeper than the descent to Taunton River.

The estimate provides for 5 locks, each of 25 feet lift, in addition to the tidal locks, to reach the summit level from Weymouth Fore River. The first 2 of these, located at Weymouth landing, are arranged as tandem locks, and are built double. The other 3 locks are built single, and are located on one side of the centre line, so that a companion lock can be built in the future without disturbing the existing one.

Between the summit level and the tidal lock in the Taunton River the estimates provide for 7 locks, with lifts varying from 21 to 16 feet; they are all single locks, arranged the same as the single locks between the summit level and Weymouth Fore River.

The locks are all planned to be 60 feet wide and 550 feet long between the hollow quoins, this length being divided into two chambers, respectively 350 feet and 200 feet, by a set of middle gates. The total length of the lock structure over all is about 730 feet, and the depth on the sill 25 feet. The gates are planned to be of steel, and of the standard mitre form.

In addition to the operating gates, the estimates include guard gates at both ends of all the single locks, and at the foot and head of the combined locks at Weymouth landing; so that, in case of accident, by closing the guard gates the lock may be pumped out and repairs made without interfering with the other portions of the canal.

The estimates for the locks, as well as for the other structures

in the canal, are principally based on the designs and estimates made by the United States Board of Engineers on deep water ways, and on those of the State engineer and surveyor of New York for a 1,000 ton barge canal from Lake Erie to tide water.

Lock Approaches.

The estimates provide for the construction at both ends of each lock of vertical walls either of concrete or timber cribs, to guide vessels into the lock and allow for their being tied up awaiting the opening of the gates. These are planned so that, in case an additional lock is built later alongside of the existing one, as small a portion as possible of the existing structures will have to be torn out and rebuilt.

By-passes. — Waste Weirs.

The estimates also include the cost of the necessary structures to maintain the level of the water in the canal by discharging any surplus over spillways or waste weirs either into adjacent streams or artificial channels, which will take the water around the various locks into the level below, or waste it into existing streams. These are designed to care for the largest freshet which is likely to occur on the water-shed. It will probably be necessary to enlarge the standard section of the canal in a few places, to enable it to pass the flood discharges; but the time has not been sufficient to go into this matter fully, but, in any event, it will not be a large additional expense.

Estimates have been made for two masonry dams at the two ends of the canal across the Taunton and Weymouth Fore rivers opposite the tidal locks, to impound and maintain at about high-tide level the water in the rivers and tide-level sections of the canal. These, as in the case of the waste weirs of the canal, have been designed to take care of the flood discharges without unduly raising the water level either in the canal or rivers.

Stream Crossings.

As the canal generally follows the thread of the streams flowing through the valleys in which it is located, it receives the natural drainage from the water-shed; and, as the water supply of the canal is to be supplied by pumping water from the Weymouth Fore River, the drainage into the lower levels will be discharged through the waste weirs into the streams where they diverge from the line of the canal; and the Town River, which crosses the line of the canal at West Bridgewater, is to be conducted through a

culvert under the canal, so that the water supply to the streams below will not be interfered with. The mills and dams on the streams at South Braintree and Raynham, lying, as they do, directly in the line of the canal, are necessarily destroyed.

Diversion of Railroads and Highways.

In planning for the construction of work of this magnitude, it is impossible to avoid interfering with many existing structures. The proposed line of the canal crosses the various lines of the New York, New Haven and Hartford Railroad at eight places, in addition to the existing drawbridges at Somerset and Slade's Ferry, and the freight yard at Brockton. At four of these places the crossing cannot be avoided, and estimates have been made for drawbridges. At the others, estimates have been made for diverting the railroads so as to avoid their crossing the canal.

Forty-six highways now cross the line of the canal. Estimates have been made for 14 drawbridges, and for rearranging the highways and diverting some of them. The plans have been so arranged that the distance to be travelled in most cases will not be materially increased over the distance between the same points by the existing routes.

The railroad bridges are all planned for two tracks, except the one at Campello, which is planned for four. The highway bridges, are planned to carry an electric railway, to have a roadway 34 feet wide, and two sidewalks, the whole to be 50 feet wide over all.

In all cases the clear width for the passage of vessels is to be 100 feet, except in the four-track bridge, and where the bridges are located at the ends of locks; in these cases the clear passage-way is to be 60 feet, the same as the width of the locks.

Owing to the sharp angles at which the railroads cross the canal in some places, and at others to the curves in the railroads, it was found necessary to plan slight deviations in the locations of all the railroads but one, in order that they might cross the bridges on tangents, and more nearly at right angles to the line of the canal. The estimates include the cost of a new railroad bridge across the Taunton River at Somerset, as the draw in the present bridge is not adapted for the convenient passage of large vessels.

Protection of the Walls and Banks of the Canal.

Wherever the water level of the canal will be above the present surface of the adjacent country, the embankments on the sides are planned to have puddle walls of clay built through their centres; and wherever the banks of the canal throughout its length consist

of earth, the estimates provide for protecting them with a coating of broken stone, extending from 5 feet below the water level of the canal to 5 feet above that level, as shown on the standard cross-section, in order that they may not be injured by waves created by passing vessels.

Turning Basins.

In order to enable vessels to enter the canal from either end with cargo for any of the cities or towns on the line of the canal, turning basins or harbors have been provided at Taunton, Brockton and Holbrook, approximately 600 feet square, where vessels may be turned around so that they may return.

In addition to these harbors, wharf walls, to be located at various points along the canal, are included in the estimates.

Electric Power and Lights.

The estimates include the cost of an electric power and lighting plant, to be located and operated with one of the pumping stations and the necessary wire lines, lamps and motors, to operate the drawbridges, lock gates and sluices and to light the canal throughout its length.

Right of Way.

The cost of sufficient right of way to enable the canal to be constructed without trespassing on other property has been included. The area required is based on the amount of territory required to deposit the material excavated from the canal alongside of the place from which it is excavated, without piling it higher than 10 feet above the surface, and not allowing it to come within 25 feet of the bank of the canal at any point. This general plan has been modified in its application, so that through cities and improved territory a comparatively narrow strip should be taken, generally little more than sufficient for the operation of the canal; and where the land was of less value, larger areas are included, in order to allow room for the deposit of material taken from the narrower sections.

Unit Prices.

The unit prices used in determining the value of the work to be done in the construction of the canal are based very largely on those adopted by the United States Board of Engineers on deep water ways, and those used by the State engineer and surveyor of New York in making his estimates for the 1,000 ton barge canal through New York. These have been compared with the prices

paid for work on the metropolitan water system and other works in the vicinity of Boston, and modified as found necessary.

The larger part of the masonry has been estimated as concrete, stone to be used only where the masonry will be subject to wear.

Estimates.

Owing to the short time which was available for making up the estimates, and to the uncertainty as to the exact character of the material through which the canal is to be constructed, it has been impossible to make the estimates with the exactness which would have been done if time and means had allowed; and for this reason it has been deemed best to add 15 per cent. to the figures, to cover possible contingencies and unknown quantities, as well as the usual expenses attending any such undertaking. The estimates are as follows: —

Excavation, including approaches between Quincy Point	
bridge and Slade's Ferry bridge,	\$20,103,662
Backfill,	908,080
Culverts and by-passes,	980,000
Retaining walls,	1,494,660
Puddle walls,	144,317
Wash walls,	1,196,072
Spillway and waste weirs,	815,000
Stop gates,	300,000
Highway changes,	343,100
Railroad changes,	462,000
Highway bridges,	1,633,000
Railroad bridges,	1,380,000
Dams,	170,000
Locks,	12,233,000
Lock approaches,	2,406,620
Power and lighting plant,	220,000
Water supply plant,	2,532,499
Maintenance plant,	200,000
Right of way and damages,	2,580,910
Engineering and contingencies, 15 per cent.,	7,515,438
<hr/>	
Total,	\$57,618,358

The work of preparing the report and estimates has been pushed with all practicable speed, and every effort has been made to have the estimates as complete and accurate as possible with the information available; in order to do this, plans have been used before they were inked in and completed. The office force is still at work

on them, but it will be some time before they are completed, and, with the field notes, put in proper shape to record and file away.

Two plans, one showing the location and the other the profile of the proposed canal line, are forwarded herewith, together with a diagram showing the standard cross-sections on which the estimates are based.

Respectfully,

FRANK W. HODGDON.

Engineer.

INDEX.

COMMISSIONERS' REPORT.

	PAGE
Meetings, Hearings, etc.,	3
Sales and Leases,	4
Commonwealth Tide Lands,	4
Boston Harbor,	5
Anchorage Grounds,	9
Winthrop Channel,	9
Shirley Gut,	10
Hull,	11
U. S. S. "Enterprise,"	11
The Commonwealth Flats at South Boston,	11
Commonwealth Pier,	12
Northern Avenue and Bridge,	14
Bulkhead and Sea Wall on Commonwealth Flats, South Boston,	15
Borings on Area East of Commonwealth Pier,	16
The Commonwealth Flats at East Boston,	17
Fort Point Channel,	18
South Bay,	20
Charles River,	21
Charlestown Drawbridge Openings,	22
Mystic River,	23
Weymouth Fore River,	24
Merrimac River,	24
Connecticut River,	25
New Bedford and Fairhaven Bridge,	27
Cape Cod Canal,	43
Apponagansett Harbor,	58
Herring River,	61
East Bay,	66
Bass River,	66
Scituate,	67
Green Harbor,	68
Osterville,	69
Lake Anthony,	69
Menamsha Inlet,	72
Witchmere Harbor,	73
Scorton Harbor,	74
Plymouth Harbor,	75
Provincetown Harbor,	75
New Bedford Harbor Lines,	76
Great Ponds,	76
Town Boundary Survey,	78
Sale of Maps,	79
State Boundaries,	80
Province Lands,	82
Wrecks,	83

	PAGE
Surveys,	84
Inspections,	86
Licenses granted during the Year,	89
Petitions denied,	100
Miscellaneous Permits granted during the Year,	101
Work of the United States in Rivers and Harbors of the Commonwealth,	104
Statement of Lieut.-Col. W. S. Stanton, Corps of Engineers, U. S. A.,	104
Statement of Capt. Harry Taylor, Corps of Engineers, U. S. A.,	106
Statement of Maj. George W. Goethals, Corps of Engineers, U. S. A.,	108
Harbor Compensation Fund,	110
Commonwealth's Flats Improvement Fund,	111
Taunton River and Boston Harbor Canal,	111

APPENDIX.

Contracts entered into during the Year,	117
Report of Engineer in Charge of Connecticut River Work at Hadley,	119
Report of the Superintendent of the Province Lands,	121
Report of Engineer on the Taunton River and Boston Harbor Canal,	123

PROFILE OF PROJECTED SHIP CANAL FROM TAUNTON RIVER TO BOSTON HARBOR VIA WEYMOUTH FORE RIVER, UNDER CHAPTER 104 RESOLVES OF 1901

